The Mining Journal

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India's Coal Drive

COMPARED with the living standards enjoyed in industrialized countries, those in the Indian sub-continent are deplorably low and even to effect a relatively slight rise will necessitate an immense rise in the supply of primary energy. Annual *per capita* consumption of fuel—a direct measure of living standards—is measured in hundredweights in India, and if this country is to approach even remotely the four to five tons of coal equivalent consumed per head of population in the highly industrialized countries, then the production of fuel within India must be increased several times over. It is apparent that if India is to open the door to an expanded economy then it is coal—still the world's major source of primary energy—that must provide the key to that door.

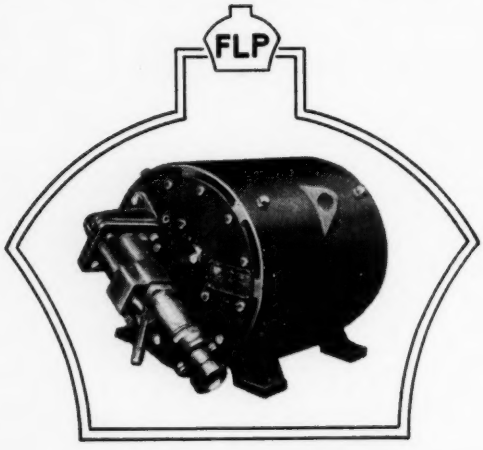
Fortunately for India, there is sufficient coal lying dormant under the feet of her teeming millions to serve projected needs for very many years but unfortunately, the country is woefully lacking in the technical skill and equipment required to prise it loose. As is well known, India is at the start of her third Five Year Plan and it would appear that the primary objective of this plan is a substantial expansion of its coal mining industry. It is true that efforts have been made during the course of the previous plans to boost coal output but they have met with only limited success.

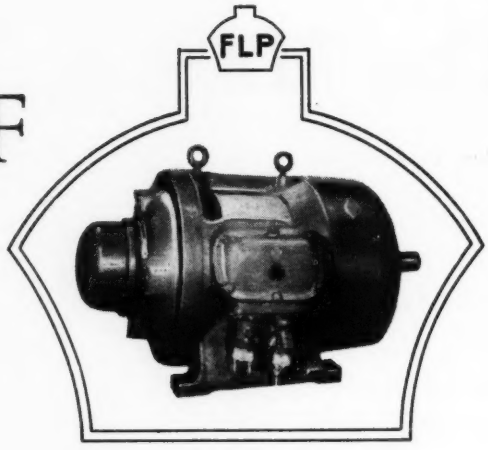
It is probably safe to assume, however, that this cautious expansion was by intent inasmuch that the Indian government was more concerned during the past decade with providing increased steel capacity and heavy industrial plant than in substantially expanding the coal mining industry. This appeared to be a logical policy since it is of no avail to provide millions of extra tons of fuel if general industrial capacity is not big enough to utilize such additional coal supplies.

With the emphasis on the secondary industries—deliberately so-called in the context of mining as the primary industry—has come the emergence of the steel works at Durgapur and elsewhere, striking witness to the strenuous effort of the Indian government towards increasing steel capacity and so in turn providing for the growth of adequate manufacturing industries. Unfortunately for India, the population is increasing more rapidly than the nation's industrial potential and if this trend continues, it appears likely that steel production and coal production will inevitably become out of phase. In other words, what appeared ten years ago to be the right phasing of having first the healthy infant in the steel industry and then the subsequent expansion of the coal industry to maintain and expand it, may not now appear to be so desirable. Possibly developments in the steel industry will overun the capacity of the coal mines to satisfy its need for coal.

During the second Five Year Plan, Indian coal production increased from 40,000,000 tons in 1956 to rather less than 50,000,000 tons last year. Not a very substantial increase in output and certainly not achieved by any significant gain in

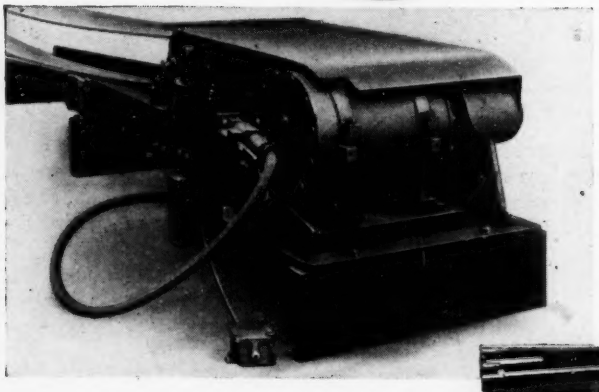
FLAMEPROOF





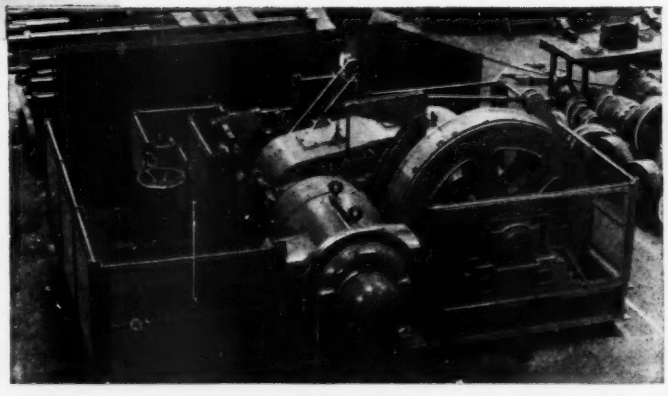
Top Left: *Totally-enclosed fan-cooled flameproof squirrel-cage motor, type KF.*
Top Right: *T.E.F.C. flameproof slipring motor, type FW.*

AEI Motors for Mines



Flameproof squirrel cage and slipring motors are manufactured up to 1000 hp at 1500 rpm for mining applications where inflammable gases are encountered. A complete range of non-flameproof motors is available for miscellaneous services. Write for full details.

Above: *Type KF flameproof motor driving a "Huwood" conveyor.*
Right: *125 hp, 580 rpm totally-enclosed, fan-cooled, flameproof slipring induction motor driving Beckett and Anderson "Man-Riding" haulage for a colliery. Electro-hydraulic thrustor operating main brake is seen on left of motor.*



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productivity. With an estimated labour force of 350,000, Indian productivity stands at the very lowly figure of slightly less than 0.5 tons per man shift, the lowest of any major coal producer. During the next five year plan, the Indian government hopes to boost coal output by some 45,000,000 tons to 95,000,000 tons per year. This represents an increase of over 100 per cent. The full measure of the problem becomes apparent when it is remembered that it takes several years for a new colliery to be developed and brought into full production, and that the mechanization of existing mines does not merely involve pouring in machinery but also necessitates trained operators and effective supervision.

Much depends on what preparatory work has been done during the ten years' grace allowed the industry. Such work cannot of course have been reflected in past output statistics. What for example has been done regarding the training of the large numbers of qualified mining engineers and technicians that will be necessary to carry through an expansion of such magnitude? Ideally it is now at the beginning of the plan that they should be ready or at least nearly ready. Effective mining engineers are not made overnight. Have the university and technical college departments been sufficiently expanded and staffed to deal with the larger number of students that are needed? In some cases the answer must be no.

There are several other pertinent questions which come to mind when considering the Third Five Year Plan. Where, for example, is all the extra coal to come from? The Indian governments have for long insisted that new mines could only be opened in the public sector but as it appears that private sector mines are to take the lion's share of the 1965 target figure of 95,000,000 tons, some relaxing of this policy appears inevitable.

Last year the Indian government solicited advice from foreign mining engineers including representatives of Britain, France, Poland, Germany, Russia and the United States, who visited the country and reported on the steps to be taken to meet the requirements of the third Five Year Plan. As a result of this, it is expected that the United States, the United Kingdom and Poland will soon be allowed to work public sector mines using their own personnel and techniques. After two or three years, the mines will be handed back to the Indian technicians of the National Coal Development Corporation. The total number of mines concerned, however, is unlikely to be large and it is difficult to see how the limited use of foreign experts is going materially to affect the overall picture.

Next where is the money to come from for the vast mechanization programme necessary to expand the industry effectively? As reported in *The Mining Journal* leader of April 21, there has been a radical improvement in the facilities offered by the Export Credit Guarantee Department which should make it easier for the Indian government to negotiate long-term loans for mining machinery. It is also understood that the British Government has recently granted a loan of about £1,500,000 to the government of India to be used for the purchase of mining equipment. Doubtless this loan will be tied to British mining equipment.

The recently announced World Bank loan of £20,000,000 if approved, will also help finance Indian colliery expansion plans. Although this is a large sum it would possibly only result in a few million tons extra annual capacity and certainly cannot be considered as the total amount necessary to transform the industry.

Fortunately for India, many of her deposits are at shallow depths and can be mined with greater facility and less cost than deeper seams, but nevertheless an increase of 45,000,000 tons per year is going to require a considerable amount of capital.

Finally, who is going to provide the necessary equipment? If the World Bank loan is granted, the equipment required will as usual with such loans go to tender. British manufacturers must stand a good chance of getting much of this business, although it will be essential for them to get to close quarters with the problem. The days of full order books from the National Coal Board are gone and with it the attitude of some manufacturers that overseas business can be comfortably conducted by remote control from head office in the United Kingdom.

Whether or not British manufacturers, already enjoying a good reputation in India, can take over much of this large new market remains to be seen. What is of equal importance is can they hang on to it? It is the declared intention of the Indian government to create its own manufacturing plant wherever practicable, and it is only by convincing the Indians that the United Kingdom can produce better mining machines at lower cost than the indigenous product that this important market will remain open.

WESTERN AUSTRALIA TO EXPORT IRON ORE

A prominent question in Australia these days is how to produce more iron and steel and how to find iron ore for export. In spite of the huge construction programmes and heavy capital expenditure of The Broken Hill Proprietary Co., Australia has, for a time at least, become a steel importing country, so great has been the expansion of domestic demand .

Eyes are now turned to Western Australia for partial solution. Agreement has been reached between Broken Hill and the Western Australian State Government for the erection at Kwinana of an integrated steel plant with an ore supply basis reinforced by the W. Australian deposits at Koolyanobbing, Dowds Hill and Bungalbin. It is, however, contingent upon the construction by the Commonwealth Government of a standard gauge railway from Kalgoorlie through the iron ore fields to Kwinana for the transport of ore, fluxes, fuel and products. But as there has been no government statement on this essential point, some anxiety has arisen over the future of the project, and it is felt that one is overdue. One problem seems to be that the government is having to review its railway standardization plans and to give priority to the Kalgoorlie-Freemantle link would mean putting it ahead of the project to convert the narrow-gauge line that links the Broken Hill mines with the smelters at Port Pirie. The estimated cost of the Kalgoorlie project has been put at around £A40,000,000. In the meantime preliminary work has been put in hand, and control of the iron ore deposits has passed to Broken Hill.

Linked with the expansion of the steel industry was the question of exporting iron ore. The way has been cleared by the lifting of the 23 year old embargo and prerequisite conditions have been laid down. Thus deposits of approximately 1,000,000 tons can be worked but export of ore from certain defined areas in W. Australia and S. Australia, comprising major deposits useful to the local steel industry, is prohibited. However, early shipment of ore is expected from the Mount Goldsworthy deposit, 60 miles east of Port Hedland, which has been drilled and is comparatively large, of high grade and reasonably accessible to a port.

The West Australian government has already negotiated a plan for the export of some 15,000,000 tons of iron ore to Japan. Provisionally it has been planned to export this quantity over 15 years from Mount Goldsworthy, and it is further planned to export an additional quantity from the

ELECTRIC SMELTING ON APPROVAL

trial tests on raw materials

for the first time in this country

Preparing to tap the pilot smelter

For the first time in this country a contract service is available for electric smelting. A pilot smelting furnace, built by Birlec-Efco (Melting) Limited, is in operation at the Company's Aldridge premises to promote the development of electric smelting processes. The furnace, which is available to companies throughout the world, provides full scale testing facilities for the mining and electro-chemical industries.

Raw materials are accepted in trial batches for testing their amenity to electro-thermal reduction and for determining the most suitable smelting technique and the nature of the resultant products. At a fee agreed in advance the pilot smelting furnace is operated on customers' raw materials. Finished products and the balance of materials are returned to customer. At the end of the test Birlefco presents a full report giving recommendations on smelting practice, electrical ratings and size of installation required for a given output.

Electric Smelting of

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IRON ORES

MANGANESE ORES

FERRO CHROME

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NICKEL AND COPPER CONCENTRATES

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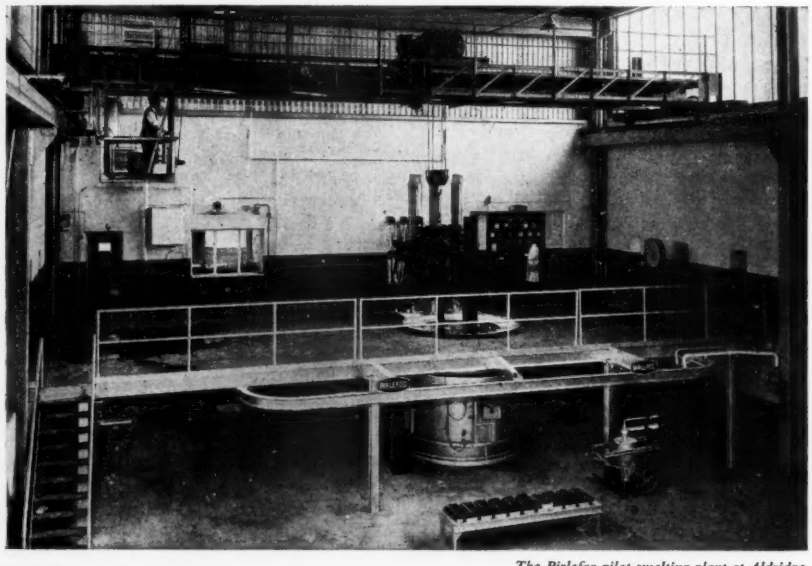

The Birlefco pilot smelting plant at Aldridge

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Tallering Peak deposit, but as yet no tonnages have been disclosed.

These negotiations are of great importance to Western Australia, for the contract could be worth over £60,000,000. The main problems are the transport facilities. The rail and road facilities are probably adequate, but Port Hedland itself has certain limitations both in terms of the stockpile capacity and in terms of the size of vessel which it can accept. However, it is understood that it can handle vessels with a capacity of up to 10,000 tons.

In these discussions with Japan, Western Australia has had the advantage of being much closer than many of the other exporters such as South Africa and Brazil. In fact, Mount Goldsworthy is only 4,500 miles from Japan.

MALAYA TO HAVE ALUMINIUM MILL

Aluminium Ltd. of Canada, for many years a miner of bauxite in Johore through its associated Southeast Asia Bauxite Ltd., is now forming another associated company—Alcan Malayan Aluminium Ltd.—to construct and operate the Federation of Malaya's first aluminium rolling mill.

A 15 acre site at Petaling Jaya, outside Kuala Lumpur, has been chosen for the $M.4,000,000 plant, which will have an annual capacity of 2,000 tons of flat sheet, circles and building sheet. The proposed plant will have a modern four-stand two-high rolling mill train with furnaces for smelting and annealling, as well as semi-fabricating equipment. The mill will use aluminium ingots imported from Canada.

Mr. N. Warren Waterhouse, on a special mission in Southeast Asia, for Aluminium Ltd. has stated that construction work will be put in hand immediately. His company is financing the project and will provide the technology. Copper producers please note !

FUTURE OF THE KOLAR GOLD FIELDS

Mr. Morarji Desai, the Indian Finance Minister, has categorically denied that there is any question of closing down the Kolar gold mines. On the contrary, he told Parliament recently, " the proposals which are now under consideration in regard to these mines will facilitate an improvement in their working and a better and more systematic ultilization of the payable ores."

What apparently prompted this denial was a statement purported to have been made shortly beforehand by Mr. B. D. Jatti, the Chief Minister of Mysore, about the possibility of closure of the nationalized gold mines in the absence of aid from the central government.

Mr. Desai chose the occasion to clarify the position regarding these mines. The Kolar gold mines, he said, had been acquired by the Mysore government towards the end of November, 1958, as a nationalized departmental undertaking. The gold mined in this area, and in the Hutti gold fields in Raichur District, after being refined and cast into bars, used to be sold in the open market until the middle of 1958, but a decision was taken in July, 1958, that the entire production of gold in the country should be acquired by the central government to be held as non-monetary stocks at its disposal. He explained that under the regulations relating to transactions in gold, by which India was governed as a member of the I.M.F., the price which had been paid for this gold had been the international parity price of Rs. 62.50 per tola, but in order to avoid any dislocation in the finances of the Mysore government which had been producing this gold at a substantially higher cost, price assistance was being given to the Mysore government purely as a temporary arrangement.

" In view of the need for making more adequate and satisfactory arrangements and having regard to the technical problems encountered in the mines, which are among the deepest in the world, the central government has been considering, in consultation with the Mysore government, the question of taking over these mines to be worked directly under the control and supervision of this government. The government of Mysore has agreed in principle to the transfer of control over these mines, and details of the arrangements for taking them over, including necessary administrative arrangements, are being worked out. It is intended that the government of Mysore should be associated in an appropriate manner with the running of the mines," said Mr. Desai.

He pointed out that the central government hoped shortly to arrive at a decision in regard to these matters, but in the meantime, there was no question of the mines being closed.

Meanwhile, the Mysore Chief Minister, Mr. B. D. Jatti, told the State Legislative Assembly that the state goverment could not continue to run the Kolar mines profitably, even if they were converted into a corporation, unless the central government agreed to continue its aid. Explaining why he was thinking of handing over the undertaking to the central government, he said the difference between the official rate and market rate of gold was too much to be ignored and the government would not be able to run the mines if it received only the official rate for the metal. The market rate per oz. in 1959-60 was Rs. 332.92, while the international (official) rate was only Rs. 166.67. The International Monetary Fund's rules did not permit the sale of gold at the market price. He also informed the house that the ore milled in 1959-60 amounted to 647,369 tons and the cost of production was Rs. 290.57 per oz.

BRAZILIAN MANGANESE POTENTIAL

Some 100,000,000 tonnes of manganese ores exist in provable quantities in Brazil, according to the West German mining journal *Glückauf*. At present Brazil, with an annual output of some 1,000,000 tonnes, produces eight per cent of the world's manganese and is the third largest producer country. Of the provable 100,000,000 tonnes, some 60,000,000 tonnes are known to exist in the Urucum district of Matto Grosso State. With an average content stated to be in the region of 40 per cent Mn and 11 per cent Fe, these deposits have not yet been exploited.

A further 30,000,000 tonnes are located in the Amapa district of Brazil. With an average of 46 per cent Mn and 3 per cent Fe, these reserves are exploited jointly by the Bethlehem Steel Co., of the United States, and Industria Comercio de Mineriais S.A. (INCOMI), of Rio de Janeiro.

Some 7,700,000 tonnes of manganese ores of exploitable quality and condition and with Mn contents of over 40 per cent exist in the Minas Gerais area, where deposits are situated in the Lafaiete, Sande, Sao Joao del Rei, Itabira and Serra do Cipo districts. Small but developable deposits are further located in the Bahia area. Reserves are of some 2,000,000 tonnes of ore with Mn content of between 40 and 50 per cent and Fe content of up to 6 per cent.

Europe's Major Source of High Gr

THE major steel industries of Europe depend on a variety of sources for their supplies of iron ore. The United Kingdom and the countries of continental Europe while possessing large reserves of low grade ores, especially of the minette type, lack substantial deposits of high grade ore.

Sweden alone in Western Europe contains large reserves of high grade ore. Of these reserves, by far the larger part occur in Northern Sweden, north of the Arctic Circle. Despite the major discoveries of recent years, especially in Canada, South America and Africa, all of which can deliver ore at competitive prices to Europe, Sweden remains, and will continue to be, a vitally important source of iron ore for Europe.

Iron ore occurs in two widely separated areas of Sweden. In central Sweden there are numerous small deposits. With the exception of the Grängesberg, the largest in central Sweden, most deposits are low in phosphorus and sulphur and are either high in iron or readily enriched by concentration. These deposits amount to less than 10 per cent of the country's reserves but have long formed the basis of Sweden's steel industry. In Northern Sweden the remaining 90 per cent or so of the iron ore reserves occur in a few large deposits dominated by the great orebody at Kiruna.

Types of Ore

There are four principal types of iron deposit which occur in Sweden, namely, the apatite ores of the Kiruna type, the skarn and limestone ores, the quartz-hematite ores and the titaniferous ores. The apatite ores are by far the most important, both in terms of reserves and of exploitation, while the titaniferous deposits at present have little or no commercial value.

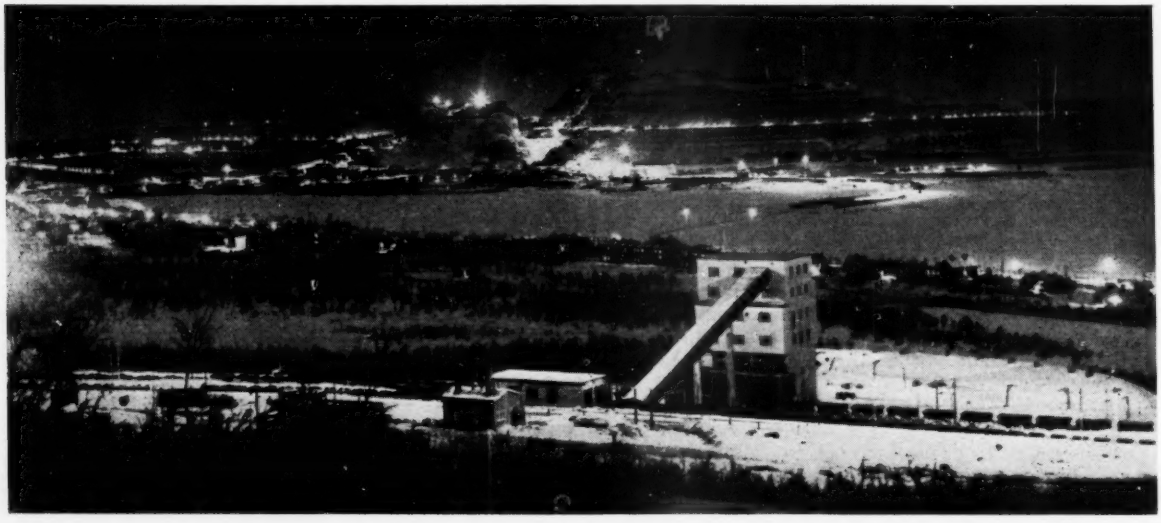
The apatite ores are represented in the north by Kiruna and Malmberget as well as by a number of deposits in the Svappavaara area south-east of Kiruna. Reserves in these three areas alone probably total more than 3,000,000,000 tons, while even in central Sweden more than half the iron ore reserves are of this type. Overall the apatite ores account for more than 90 per cent of Sweden's iron ore resources, and they likewise dominate both production and exports.

Ores of this type are of pre-Cambrian age. In northern Sweden, they normally occur in a series of porphyries. Thus at Kiruna the ore occurs as a great slab between a quartz-porphyry and a syenite-porphyry with a dip of about 55 deg. to the east. In spite of the great crustal movements in the area, the Kiruna orebody has been relatively unaffected by metamorphism compared with the Gällivare (Malmberget) deposit which has been completely recrystallized and sheared into a series of lenses. The occurrence of the primary constituents of the porphyries in the ore leads to the belief that the ore was derived from the same magma. On the other hand, the intrusive relations with wall rock show evidence of injection under conditions of high mobility.

The primary ore mineral is magnetite but some hematite is present. Essentially the ore occurs as a mixture of magnetite and fluor-apatite, the only carrier of phosphorus. Most of the Kiruna ore is high in phosphorus (2 per cent) but there are abrupt changes in the magnetite/apatite proportions, some areas containing less than 0.05 per cent phosphorus.

The Gällivare orebody at Malmberget, some 50 miles S.S.E. of Kiruna, is considerably smaller. Of similar origin, it has been much more intensely metamorphosed. The recrystallization of the ore has resulted in a grain size of about 1 mm., a factor which is of great importance in the concentration of the ore. Like Kiruna, the ore mineral is primarily magnetite with some hematite but the phosphorus content is somewhat lower at around 1 per cent. These two deposits together account for something like 75 per cent of the production in Sweden and over 80 per cent of the exports. Plans have also recently been announced to ex-

Flood lighting on the slopes and terraces of Kiirunavaara



gGrade Iron Ore

ploit similar ores in the Svappavaara district between Kiruna and Malmberget.

In Central Sweden, the apatite ores are geographically restricted to a relatively small part of the region and are represented by only a few deposits including Grängesberg, Blötberget and Idkerberget. Of these the Grängesberg deposit is the largest and most important with reserves estimated at 100,000,000 tons. Like Kiruna, the orebody is a more or less coherent slab with a steep dip. It has been proved down to 800 m. Worked at one time opencast, the operations are now wholly underground. Both sub-level and block-caving methods are used. The ore is a dense homogeneous magnetite with some hematite and contains about 60 per cent iron and 1 per cent phosphorus. Some of the ore is concentrated.

Next in importance are the quartz-hematite ores, some of which are banded. They resemble, with local variations, the quartz-hematite ores of the Lake Superior type which are found in the pre-Cambrian in many parts of the world. Low in phosphorus and sulphur, they consist essentially of hematite and quartz. Often the iron content may be as low as 32 per cent but they are amenable to concentration. There has been much discussion on the origin of this type of ore. It is generally considered, however, that they are of sedimentary origin and the result of precipitation of iron oxides and silica. Important deposits of this type of ore include Stripa, Striberg, Strassa and Pershytte as well as deposits in the Norberg, Riddarhytte and Haksberg regions.

The deposits of skarn and limestone ores are numerous but small. A few are manganiferous with up to 12 per cent Mn; most contain less than 1 per cent Mn. Phosphorus is very low but sulphur is invariably present as pyrite or other sulphides. The iron analysis varies between 30 per cent and 50 per cent. Since the iron is present as magnetite, except where martitization has occurred, concentration is widely practised.

These ores are known in many parts of the world and there is little doubt that they are the result of contact thermal metamorphism which caused reactions between iron ores, silica and limestone or dolomite to give a wide range of silicate minerals including garnets, pyroxenes, amphiboles and olivines, especially the lime-bearing varieties. Persberg, Bodas, Ställberg, Tuna and Dannemora are ores which fall in this category.

The titaniferous iron deposits, as has been mentioned, are of little economic importance at the present time. Too high in titania to be acceptable for iron making, they are too low in this element to be of any value as a titaniferous ore. The largest deposit in Sweden is Mt. Taberg consisting largely of titaniferous magnetite and olivine. Reserves are between 100-200,000,000 tons containing 32 per cent iron and 6-7 per cent titanium

Chemical Composition

While the chemical analysis of iron ores will vary from deposit to deposit, there is a close relationship between the type of ore and its expected anlysis. Thus the apatite ores, as their name implies, are high in phosphorus. Since they form such a large proportion of Swedish production and exports, the needs of the European steel industries have to be closely watched according to the type of steelmaking process used. At Kiruna, a number of grades are produced ranging from 66 per cent Fe and 0.07 per cent P to 59 per cent Fe and 1.8 per cent P. The range of analyses at Kiruna reflects the variations in the orebody itself and can only be obtained by careful planning in the mining operations. Where concentration is also practised, as at Malmberget and Grängesberg, the chemical analysis of the product can be considerably modified. Generally speaking, however, it can be said that the apatite ores contain 60-66 per cent iron with phosphorus up to 4 per cent (mostly 1-2 per cent) and silica between 3 and 10 per cent. Sulphur and other impurities are low.

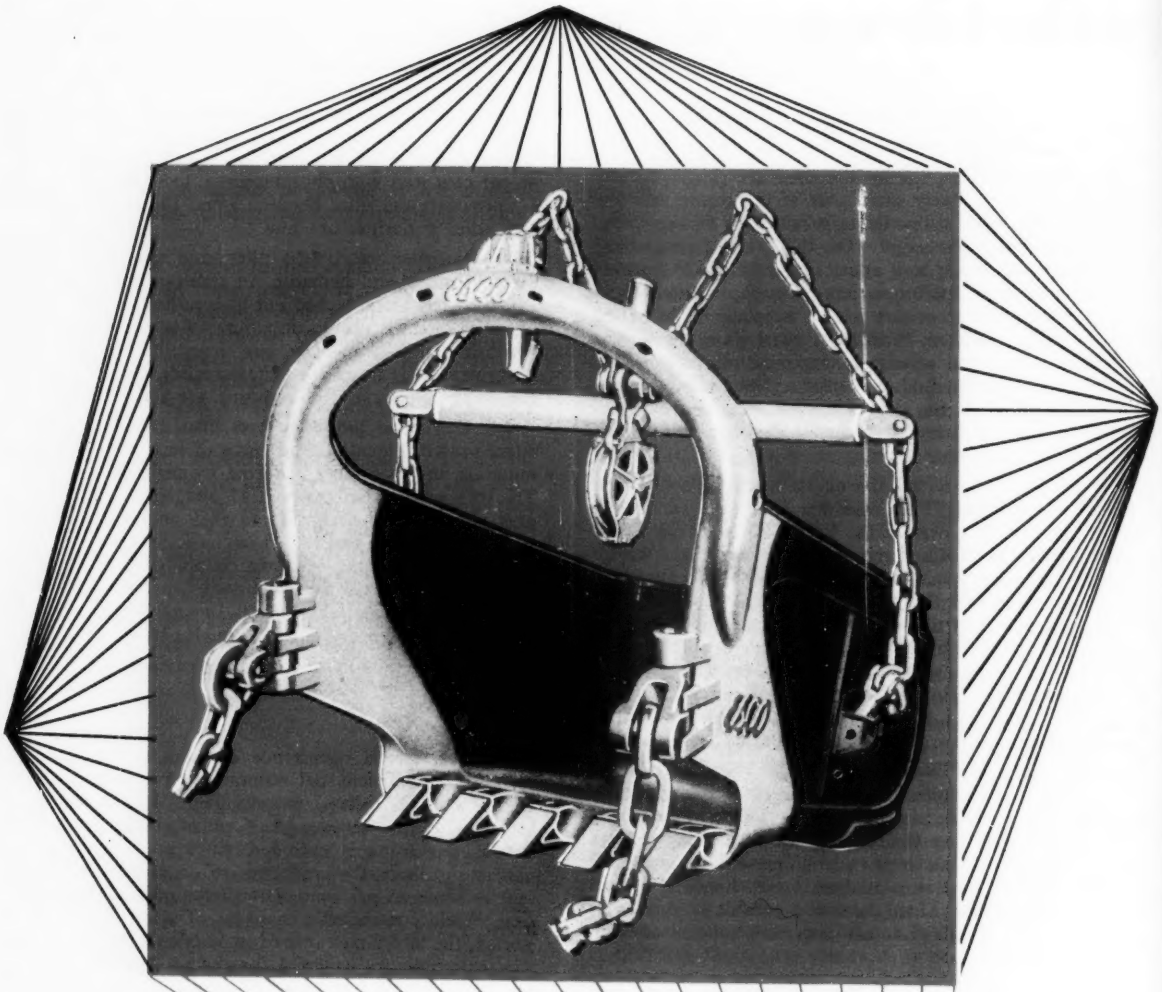
The quartzose ores, on the other hand, are essentially mixtures of silica and hematite. In some parts of the world the silica has been leached out by weathering and enriched hematite deposits occur containing 68-69 per cent Fe. The Swedish deposits, however, are generally low grade and concentration is necessary to reject silica. Other impurities, especially sulphur and phosphorus, are always very low.

The skarn and limestone ores also usually need to be concentrated. Essentially mixtures of magnetite and skarn minerals, this is readily achieved by magnetic separation. The iron usually lies between 32 and 50 per cent but the ores are classified according to their manganese content, namely those with less than 1 per cent Mn and those with between 1 and 12 per cent Mn. Sulphides often occur and have to be removed. Silica is usually in the silicate form, combined with especially lime and magnesia but also manganese and some iron; quartz may also be present.

Concentration

The widespread occurrence of iron as magnetite encourages the efficient and economical magnetic concentration of many Swedish iron ores. Some 10 per cent of the total ore production is in the form of concentrates. If the output of Kiruna is excluded, since no concentration is carried out there, the proportion of concentrates is equivalent to some 25 per cent of the remainder of the production. While considerable tonnages of concentrates are exported, the larger part is used in Sweden where high grade raw materials are essential for the production of sponge iron and of pig iron used in the manufacture of special steels. Furthermore, since Sweden must import all its coke or coking coal for ironmaking, it is essential to smelt the richest possible burden in the interests of fuel economy in the blast furnace.

There are many small concentration plants in Central Sweden. In terms of output, Malmberget and Grängesberg are the largest. At Malmberget, the recent completion of the new concentration plant raises the capacity to 600,000 tons p.a. of pelletizing concentrates or 1,200,000 tons p.a. of coarse concentrates. The feed for the concentration plant is the 10-50 mm. middlings fraction from the sorting plant, through which all the run-of-mine ore is passed. The 10-50 mm. material with 40-45 per cent Fe is initially ground in rod-mills to 1 mm. At this size, due to the coarse grain size of the ore, three-stage magnetic concentration yields concentrates containing 66-68 per cent Fe and 0.1-0.2 per cent P. If finer concentrates are required with lower phosphorus contents, any proportion of the coarse concentrate can be fed to ball mills, where it is ground to −30 mesh. A second magnetic concentration step yields concentrates with 71 per cent Fe and 0.01 per cent P. This fine concentrate can alternatively be exported or passed to another series of ball mills for grinding to below 200 mesh for the pelletizing plant. This mill is therefore extremely flexible and can within wide limits produce a variety of concentrates according to demand. During magnetic concentration the apatite and any hema-



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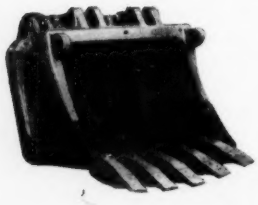

MOVE THE RIGHT WAY WITH ESCO

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HADFIELDS SHEFFIELD

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tite present are lost to the tailings and consideration is being given to their subsequent recovery by further concentration.

The pelletizing plant now has a capacity of 350,000 tons p.a. Pelletizing is carried out in drums using ferrous sulphate as a binder. The green pellets are fired in vertical kilns to produce hard-burned fully-oxidized pellets with 69 per cent Fe.

This plant is typical of the type of concentration carried out on magnetite ores in Sweden. At Grängesberg, a combination of gravity and magnetic methods is used to produce both lump ores and fine concentrates. The gravity concentration makes use of the Stripa process, a sink-float process developed in Sweden, to concentrate the hematite lump ore.

Here mention should also be made of the new plant recently commissioned at Strassa, 30 miles south of Grängesberg. This new mill has an overall capacity of 450,000 tons/year of magnetite (71 per cent Fe) and hematite (56-62 per cent Fe) concentrates. Much of the output either as concentrates or pellets is destined for the new steelworks at present under construction at Oxelösund.

Concentration plays a large part in the Swedish iron ore industry and its progress has been in part due to ores which are amenable to separation processes, especially magnetic, but also to the need to produce "tailor-made" products for the needs of consumers.

By far the largest exporting company is the state-owned Luossavaara-Kiirunavaara AB (LKAB) who in 1960 produced 15,700,000 tons of ore and concentrates, including 12,000,000 tons at Kiruna and 3,700,000 at Malmberget. Planned production for 1961 is 16,600,000 tons. By 1965, production in Northern Sweden is expected to reach 20-21,000,000 tons and by 1968 could reach 24,000,000 tons—including 6,000,000 tons from Malmberget and 3,000,000 tons from Svappavaara where operations are due to begin in 1963. The United Kingdom's imports from Sweden have shown a steady increase since the Second World War. In 1960, some 4,700,000 tons were imported from Sweden, including 3,300,000 from Northern Sweden and 1,000,000 from Grängesberg. In 1961 imports may well be higher.

It is clear that Sweden will continue to be a major source of iron ore for Europe for many years to come, and is well-equipped to meet the demands for increased quantity and quality.

Mining in Tanganyika in 1960

ALTHOUGH Tanganyika's mineral exports were again a record figure, exceeding £7,000,000 for the first time, there were some disappointing features during the year. The closure of the Mpanda lead mine was already foreseen as inevitable in 1959, while in the same general area prospecting work carried out over 34,000 sq. m. of country during the last four years by Western Rift Exploration Co. Ltd. failed to reveal any new occurrences of significance. The successful extraction of pyrochlore from carbonatite seems little nearer to solution, while the development of the undoubtedly valuable deposits of phosphate discovered in 1957 will, it seems, be dependant on the establishment of a market of sufficient size in East Africa, transport costs apparently ruling out exports.

Diamonds again proved the mainstay of the country's mineral products and although the output this year from Williamson Diamonds Ltd. was almost 100,000 ct. less than the previous year, partly due to the mining grade being reduced, but also due to a strike in December, the value of exports of diamonds exceeded the previous year's figures and amounted to £4,650,000. The additional quantity was provided from stocks on hand. Gold bullion exports and lead concentrates from the Mpanda Mine both exceeded £1,000,000 in value. There were significant increases also in the value of exports of tin concentrates (£107,000), salt (£124,000), and mica sheet (£79,000). Other minerals exported included garnet, gypsum, kaolin, magnetite and meerschaum.

Diamonds

The Mwadui mine of Williamson Diamonds Ltd. was again responsible for the major part of the diamond exports of the Territory, the average amount of ground treated being over 7,900 s.tons per day. The grade treated was lower than the previous years but commensurate with the tenor of ore reserves as known at present. The prospect shaft, begun in 1959 was completed. Stations were cut at 300 ft. and 1,200 ft. depth and driving towards the pipe area was begun at both levels. There was a further extension of the exploration at the 120 ft. level from adits driven from the bottom of the opencast pits. The sample pitting programme also continued and the bulk sampling plant operated throughout the year.

At the nearby property of Alamasi Ltd., which produces about 4 per cent of the Territory's output, bringing into production the new treatment plant enabled a larger tonnage of lower grade gravels to be handled with improved recovery. The old treatment plant and the sampling plant has been temporarily closed down through water shortage.

Gold

All the principal gold mines in the country had a satisfactory year, with increases in tonnages treated and the value of bullion produced. The Geita Gold Mining Co. Ltd. operating the Geita mine and its neighbouring North East Extension, continued to explore both orebodies in depth. Diamond drilling also indicated a continuation of the ore bearing formation. There was also an improvement in the declared ore reserves which were stated to be 995,000 tons and valued at 4.1 dwts. per ton.

In Musoma District at the Kiabakari mine of the Tangold Mining Co. Ltd. a successful year was recorded. There was a 50 per cent increase in tonnage treated, and the output of bullion improved substantially. The main shaft was deepened and the driving of the 850 ft. level begun, together with winzing from the 450 ft. level. During the year, Gold Fields of South Africa Ltd. ceased to act as consulting engineers. The responsibility was undertaken by the Colonial Development Corporation. The two

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On these winding-engine hoists in two well-known Rand goldmines, Ferodo Friction Linings continue to give absolutely safe and accurate control after 20 and 15 years service respectively. The fact that the second hoist is not equipped with dynamic braking makes this achievement all the more remarkable.

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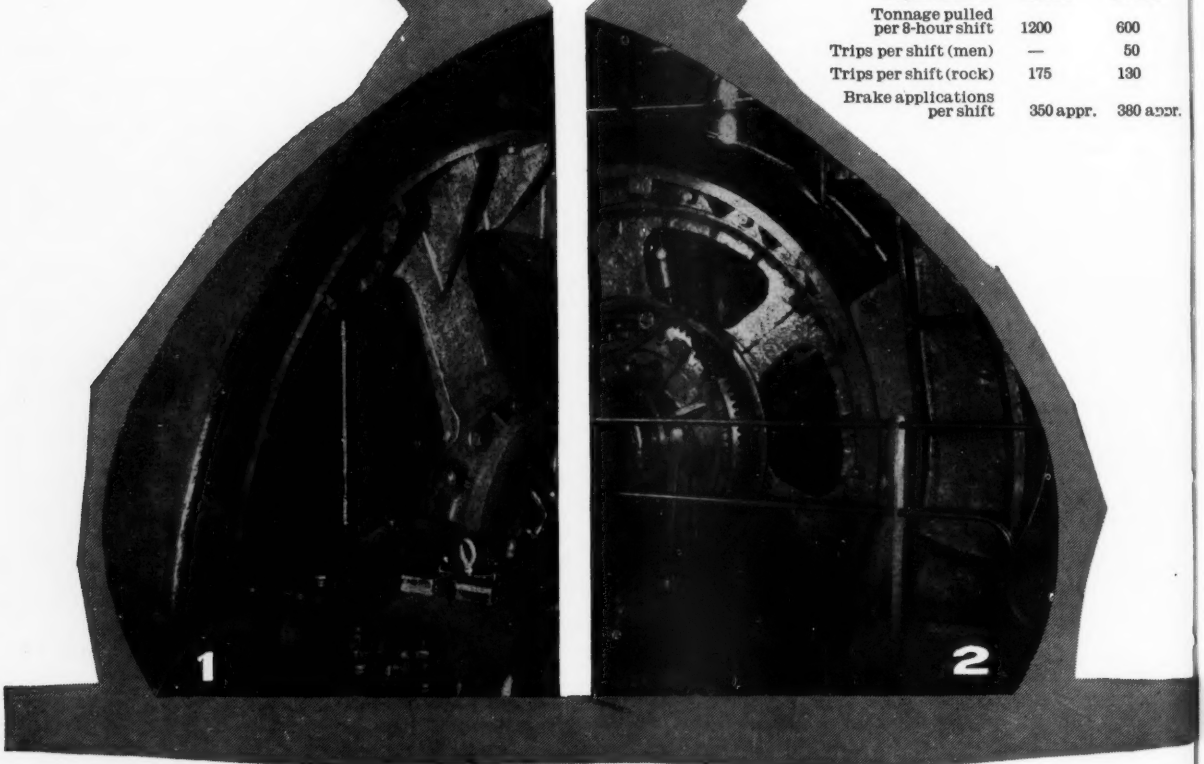
Details of hoists shown:

	HOIST NO. 1	HOIST NO. 2 (no dynamic braking)
H.P.	900	1950
Depth of shaft	2850 ft.	3500 ft.
Tonnage pulled per 8-hour shift	1200	600
Trips per shift (men)	—	50
Trips per shift (rock)	175	130
Brake applications per shift	350 appr.	380 appr.



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concerns own the share capital of the company between them. In the same district at Buhemba mine, under the guidance and control of Williamson Diamonds Ltd., improvements were made in the power supply situation and a steady effort concentrated on underground development. The result was an increase in throughput and the value of bullion produced, while a more satisfactory outlook for the future began to emerge.

The only mine of any consequence now operating on the Lupa Goldfield in the Southern Highlands Province is Ntumbi Reefs, where, in spite of labour troubles and flooding difficulties, the opening up of the ore shoot at a depth of 500 ft. was continued. The value of the bullion exceeded £22,000. Elsewhere on the gold field, small workers, chiefly African, continued to work alluvial gold remaining in the rivers. There was a slight decline in production, partly attributable to the rains being late, 993 oz. being sold to the licensed gold buyer.

Mica

The year has shown a significant improvement in the amount of mica produced and exported. The most successful operations appear to have been those by the Anglo American Vulcanized Fibre Co. Ltd. who are opening up an area south of Lake Rukwa. A mining lease has been applied for. Production of sheet averaged nearly 2 l.tons per month. Also in the Southern Highlands Province, the claims in the Bundali Hills which have been worked for many years by a European partnership were made more accessible by the opening of a new district road.

In the Morogoro district of Eastern Province, the main output again came from the two African mica mining co-operative societies who sold their mica to the two licensed dealers in Morogoro. The value of sheet produced by each society, again well exceeded £10,000.

Tin Concentrates

Improvements in haulage and milling techniques and the solving of the water supply problem, enabled Kyerwa Syndicate Ltd. to increase considerably production from their Kaborishoke mine in the Karagwe District. The amount of concentrates produced in the year was 175 tons. Exports by small workers in the field also showed a slight improvement.

Other Minerals

Attempts by the Mbeya Exploration Co. Ltd. to solve the problems of extracting pyrochlore from the host rock carbonatite continued, and at the end of the year samples were submitted to a research laboratory in the U.K. for further test work. The company also abandoned its special exclusive prospecting licence surrounding the main deposit.

Sales from the small Illima Colliery near Tukuyu exceeded 2,000 tons and two additional claims were pegged to provide further reserves for the owner. A coal claim was also pegged in Njombe district from which it is hoped that the tea estates in that district, will be able to draw their supplies.

The company investigating garnet deposits in Masasi district gave up its efforts during the year. A small quantity of gypsum was produced from the almost exhausted deposits at Mkomazi in Lushoto district, and the possibilities of development of the Kilwa deposits in Kilwa

General view of the Panda Hill pilot plant of Mbeya Exploration Co. Ltd.

district were actively examined. The Tanganyika Corundum Corporation Ltd. continued to work the ruby-corundum deposit near Longido in a small way, but no significant success in the production and sale of ruby gem material had been reported by the end of the year. At the end of the year, interest had been aroused by samples of ruby and sapphire brought in from a prospect in Lushoto district. Two exclusive prospecting licences have been applied for, and geological investigations have begun to establish the extent of the deposits and their economic possibilities.

Efforts by an African prospector to produce high grade copper ore from surface pockets encouraged other Africans in the Pare District to peg copper claims in the same locality. At the end of the year, the prospector had concluded an arrangement for the shipment of 150 tons to Japan and his prospect had been examined by the Geological Survey. It seems possible, however, that the present operations are confined to the richer zones in what may be an extensive, but low-grade mineralized area.

Prospecting

By the end of the year, the Western Rift Exploration Co. Ltd. had concluded examination of its 34,000 sq.m. special exclusive prospecting licence and was considering the abandonment of the major portion of this. The company also examined a part of the Lupa gold field, to trace a possible extension but decided not to take out any mining rights in the area.

Prospecting for diamonds by Williamson Diamonds Ltd. was carried out extensively in many parts of the country. At the Minjingu phosphate deposit, Consolidated Gold Fields of South Africa Ltd., surrendered one of their special exclusive prospecting licences but retained the original licence covering Minjingu Hill. A pitting programme was also begun at the small hills nearby known as the Pyramids, and further occurrences of phosphatic material have been found there.

Prospecting for gold still proves unattractive in the absence of a rise in the price of the precious metal. The Tangold Mining Co. Ltd. carried out a little work on two exclusive prospecting licences held in Musoma district. The smallworker prospects known as Kabassa, Rwamagasa and Kilimafeza were all under examination during the year, but the owners were not finding it easy to make headway.

A pilot course designed for African prospectors was held in Morogoro in April, followed by a second course in October. Other courses are projected in the Southern Highlands Province, and Lake Province and in Pare.

Statistics indicate that there was an average of 16,600 persons employed in the industry during the year, of which 15,660 were Africans.

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Gears for Tower-Mounted Friction Winders

TOWER mounted friction winders can be installed in either concrete or steel structures; but since the latter are not inherently rigid, gearboxes must be specially designed to accommodate any deflections occurring during normal operation of the winder.

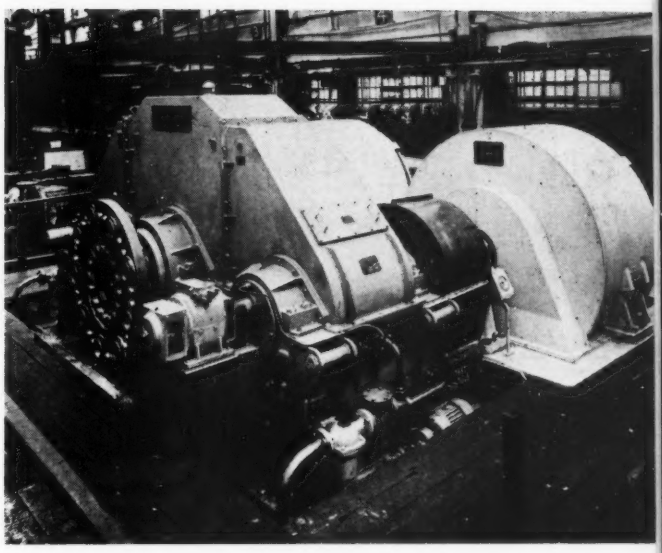
For this application the Heavy Plant Division of Associated Electrical Industries Ltd. has designed three types of gearbox, namely a double-reduction, divided-drive, co-axial unit; a single-reduction equipment; and a twin pinion single-reduction gearbox for twin-motor drives. In the co-axial arrangement, the input torque is divided equally between two first-reduction gearwheels and then transmitted through quill shafts and flexible couplings to two second-reduction pinions meshing with a final gearwheel on the slow-speed shaft. This arrangement provides the necessary torsional flexibility between the primary and secondary gears, and results in a gearbox of minimum weight and size. A further and considerable reduction in the overall length of the winder is achieved by housing the motor drive-end bearing in the gear box, the first reduction pinion being overhung on the motor shaft.

In single-reduction gearboxes with either single- or twin-motor drives, the double-helical pinions are connected to the motors through flexible couplings.

In all three arrangements, a slow-speed torque shaft is fitted between the final gearwheel and the winder, accommodated inside the hollow shaft of the gearwheel and provided with a flexible coupling at each end. The torque shaft and its couplings are designed to function satisfactorily with a misalignment in any direction of not more that a quarter-inch between the winder shaft and the slow-speed shaft of the gearbox; in addition, they provide the torsional flexibility necessary to ensure damping of the peak loads during winding and heavy braking.

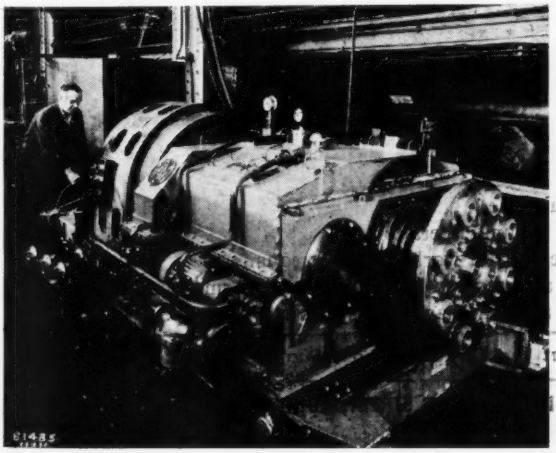
Heavy-duty bearings of the self-aligning double-roller type are used throughout, and are of ample capacity to ensure the long trouble-free life demanded of them. All gears are spray-lubricated, and each gearbox is provided with a complete and independent oil system, consisting of oil pump, strainer, magnetic filter, pressure gauge, relief valve, and low-pressure alarm.

The gear teeth are cut on modern hobbing machines, housed in temperature-controlled cells. They are machined to British Standard Grade A accuracy, thereby ensuring complete absence of noise and vibration.

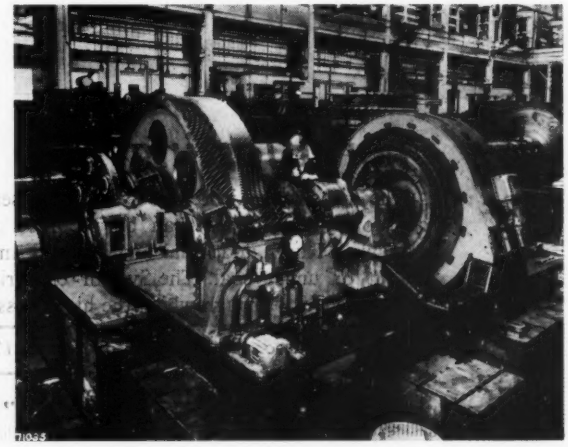


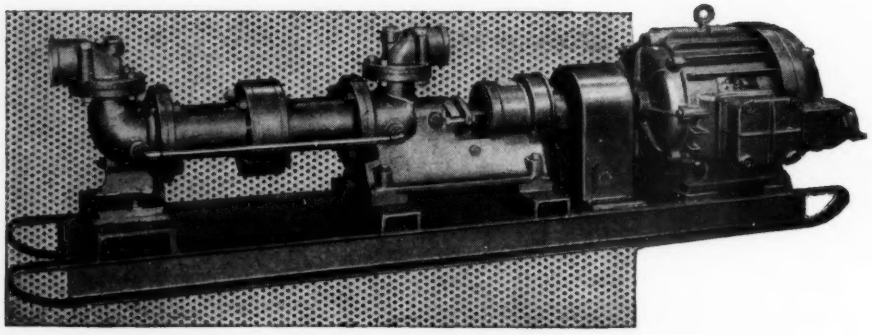
Single-reduction twin-pinion gearbox, to transmit 2,700 h.p. (r.m.s. rating), with a maximum load of 5,400 h.p. and a speed-reduction of 600/60.3 r.p.m. Supplied to the National Coal Board, Brodsworth Colliery

Double-reduction co-axial gearbox, to transmit 1,030 h.p. (r.m.s. rating), with a maximum load of 1,390 h.p. Speed reduction, 713/93 r.p.m. Supplied to the National Coal Board, Bedlay Colliery



Single-reduction gearbox, to transmit 1,800 h.p. (r.m.s. rating), with a maximum load of 3,050 h.p. and a speed reduction of 418/59 r.p.m. Supplied to the National Coal Board, Cotgrave Colliery





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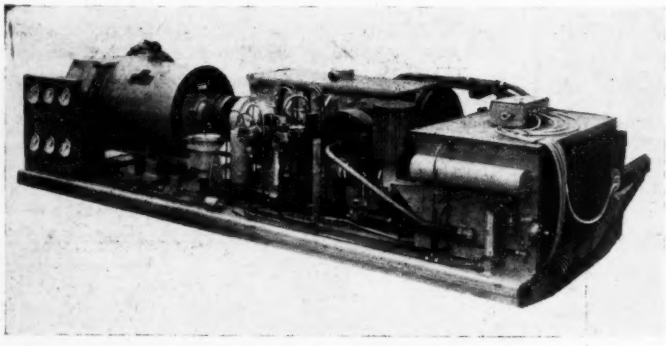

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Machinery and Equipment

Mobile Seismic Drill Rigs

One of the less common applications of rock drills is their use in seismic shot-hole drilling, in the measurement of radioactivity in rock strata and in geological survey work. The requirements of a comprehensive survey demand that a large number of holes be put down quickly, often under adverse conditions, so that a mobile drill with fast drilling speed is necessary.

In Libya, where extensive seismic and radioactivity surveys are being carried out a Joy Mobile Seismic-Air 400 is currently being used to sink the holes. This completely mobile, self-contained unit is the product of a joint effort made by Joy-Sullivan Ltd., U.K., and their U.S. parent, Joy Manufacturing Co. The machine consists of a Joy Airvane RP.600 rotary compressor, a Joy EW.111 air hoist for lowering the feed mast and hoisting drill rods, bit grinder, and hose from British production with an MW.20 feed and TM.400B 4 in. bore percussion drill from America. The whole is mounted on a Cummins engined International Model 200 truck. (See illustrations on this page).

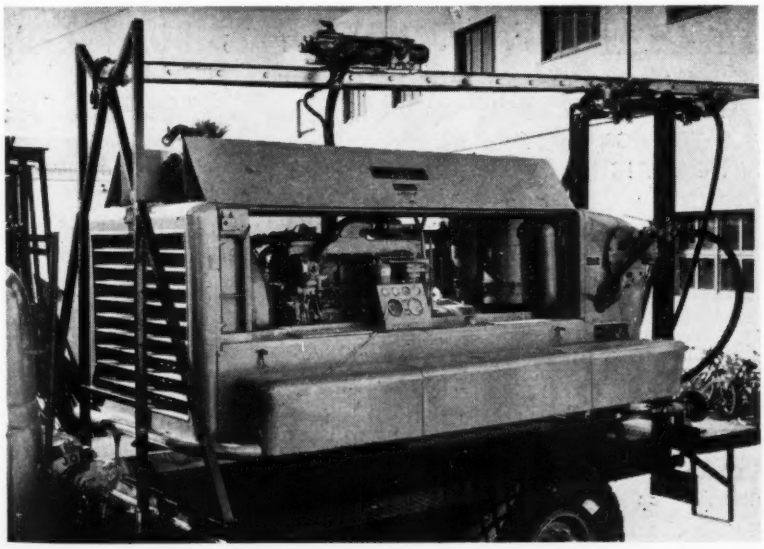
It is reported that in initial trials, this Anglo-American enterprise has succeeded in completing a 20 ft. deep shot-hole in four minutes, using 1½ in. round steels with 2 in. X-type T.C. Joy bits.

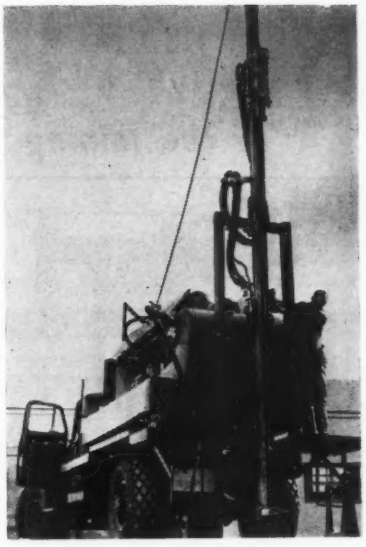
The unit is compact and extremely stable and can be supplied with a wide variety of drifters for various applications and hole depths. The TM.400B with ¾ in. air tube as used in Libya will drill to 24 ft. with steels up to 1½ in., and a similar drill, but having an air tube of $\frac{9}{16}$ in., the TM-4, will drill to 40 ft. with coupled steels of 1½ in. or 1¾ in. dia. This faster drill is of particular value where broken or fissuary ground or sandy overburden is encountered.

The larger air tube gives superior hole cleaning and reduces wear on the bit. Drills of 4½ in. bore, the TM-450 and TM-450 Dual Rotation, will drill holes of up to 4 in. dia., 40-60 ft. and 100 ft. deep respectively. All these drifters can be used with the Joy Airvane RP.600 compressor on the rig, but a Junior Seismic model mounting the Airvane 365 compressor and TM.350 Drifter is also available for lighter work and shorter holes.

There are several ways in which radioactivity in geological work is measured, the most frequent being the placing of a geiger counter at the collar of the hole where it can record the degree of activity in the cuttings as drilling proceeds. The steels are marked at intervals with chalk so that recordings are easily noted of the depth at which any degree of activity is present. Another method is to lower a probe of the counter down the completed hole on the end of calibrated line.

For research of this kind, these rigs have far-reaching possibilities and Joy already report considerable interest among survey operators.





SASKATCHEWAN'S NEW POTASH PRODUCER

In our issue of March 17, 1961, the difficulties associated with shaft sinking through water-bearing sands at the Esterhazy potash project of International Minerals and Chemical Corporation (Canada) Ltd. were described. *The American Metal Market* now adds that a 3,000 ton cast iron lining has paved the way at Esterhazy. It was to be completed in late March on the I.M.C. site.

Some 17,000 bolts have been used in putting together the cast-iron lining which protects the new potash mine shaft against a capricious geological stratum which carries oil in some areas, coal in others, and water under extremely high pressure in others. To sink its shaft through this stratum, I.M.C.'s Canadian subsidiary used a freezing and tubbing technique, described briefly in our previous note.

Before excavation could be started, it was necessary to sink 58 freeze pipes, 250 ft. long, in a circle around the shaft. Through them was run a lithium-chloride brine at minus 58 deg. F.

Freezing the area took almost a year, but when penetration was begun last autumn it was solidly frozen at minus 50 deg. F. Actual shaft sinking was accomplished with pavement breakers. Workmen went down 5 ft. at a time, installing a ring of tubbing every 5 ft. Each ring is made up of eleven 4 ton segments, each about 5 by 5 ft., to a total number of 76, running from the 1,130 ft. level to 1,488 ft.

Initial production at the I.M.C. shaft is expected during the fiscal year ending June 30, 1962. A pilot surface plant for initial production is already virtually completed and can handle about 420,000 tons of product annually.

NEW COMPRESSOR BOOKLET

Air Pumps Ltd. have produced an attractive booklet detailing the range of their oil-cooled mobile rotary compressors. Illustrated throughout, the twenty-four page booklet shows the company's 250 c.f.m., 365 c.f.m. and 600 c.f.m. models in operation on various sites and as well as giving detailed information on the compressors, it also gives specifications of the engines used to power the compressor units.

G.E.C. WINDER EQUIPMENT

The General Electric Co. Ltd. of England has received a repeat order, worth over £50,000, from the East Rand Engineering Company of Johannesburg for equipment to be used in the conversion of a winder from steam to electric drive. As in the case of the previous order, this converted winder will be installed underground at the Withok mine of the S.A. Lands and Exploration Co. Ltd., ("Sallies") of the Anglo American Corporation of South Africa.

Twin 6.6 kV. 1,150 h.p. 10-pole a.c. motors will be used to drive the 12 ft. by 5 ft. double-drum winder which will be fitted with G.E.C.'s latest closed loop a.c. speed-control equipment.

Over £355,000 worth of winding engine business has now been placed with G.E.C. during the past year for equipment for installation in Rhodesia and South Africa.

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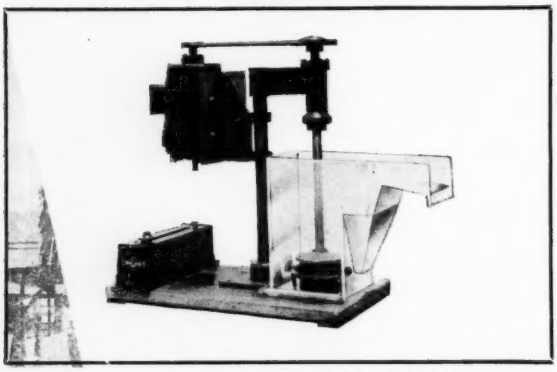

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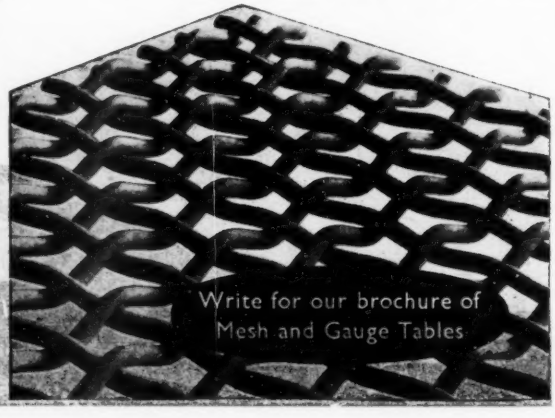


MINING MISCELLANY

As from May 1, 1961, all sales of Banka tin, tin ore, as well as other Indonesian mining products, such as bauxite, manganese ore and nickel ore, etc., will be handled by the Sales Organization for Mining Products of the government of the Republic of Indonesia.

★

A proposal that a further 118 categories of workers in the Coal-Steel Community should benefit from the Community's provisions concerning free movement of labour has been made by the High Authority. It has sent to the Community's Council of Ministers a new list containing 87 categories of jobs in the steel industry, 18 in the coal and iron ore mining industries, and 13 in those concerned with refining of ore and coking plant. It proposes that the provisions, already applied to 56 categories of jobs, should now be extended to the new list in order to qualify their workers for jobs in other countries of the Community without the need to apply for national labour permits.

★

The equipment chosen for pumping in the Vasa operation was two Flygt fully submersible electric centrifugal pumps, and a smaller conventional diesel-driven pump as an auxiliary.

★

From Salisbury, Barclays Bank D.C.O. reports that preliminary talks have been held regarding the establishment of a Rhodesian aluminium smelting industry. Representatives of Aluminium-Industrie-A.G., of Zurich, have made some investigations.

★

The Bolivian mines minister stated recently that a contract had been signed with Saltzgitter whereby the German concern will study the immediate modernization of all installations in the nationalized mines, the most important of which was owned by the Patiño family in the Department of Potosi. The Germans will also reorganize the Bolivian Mining Corporation, the State agency that has managed the mines but during the past 8 years failed to make a profit. Saltzgitter will survey the Mutun iron ore reserves on the Brazil border, which have been studied several times in the past but never developed. The German organization will also undertake to bring into production a zinc mine located near the shores of Lake Titicaca.

★

At the annual general meeting of the Council of Underground Machinery manufacturers on April 12 Mr. G. Keith Talbot of Mavor and Coulson Ltd., was appointed president, in succession to Mr. A. Yorke Saville, M.B.E., British Jeffrey-Diamond Ltd. Mr. W. F. G. Sutcliffe of Richard Sutcliffe Ltd., Wakefield, was appointed vice-president.

★

What are stated to be the first valuable lead reserves to be discovered in Iraq have been located in the province of Mosul by Iraqi and Russian explorers.

An alumina plant is to be constructed near Oradea, in Roumania, to process bauxite deposits in the north-west of the country. Building is to start in the current year. The unit, which will have an annual capacity of 120,000 tonnes, will supply the planned Slatina aluminium plant as well as other units.

★

The iron ore mines in the Rana area of Norway are all to be expanded. The country's government has granted the sum of 210,000,000 Norwegian crowns (£10,000,000) for the carrying through of this mining expansion project, which will be handled by the nationalized company Rana Gruber A/S. Annual production of 750,000 tonnes of fine-grain ore will be reached by 1966/67.

★

Hunting Surveys Ltd., of London have just been awarded the contract to photograph the whole island of Jamaica from the air under a recently announced Colonial Development and Welfare Scheme to assist the Jamaican Government. The 4,411 sq. miles of the island will be photographed at 1:25,000 scale by an aircraft of Hunting's Canadian associates which has just arrived at Kingston.

★

New ore reserves are reported to have been located at Ayios Joannis, in the Pitsilla district to the east of Mount Olympus on Cyprus. The deposits are believed to be of copper pyrites with a high metal content.

The African republic of Mali is to undertake exploration for reserves of gold, diamonds, mineral oil and other mineral fuel materials with a credit grant of 40,000,000 roubles or $36,000,000 made it by the Soviet Union. The long-term loan is repayable at 2½ per cent.

★

Five West German experts were to travel to Peru in April to examine uranium deposits located there. According to the Federal German Ministry for Atomic Affairs in Bonn, the inter-Ministerial committee for aid to under-developed countries has granted a sum of DM. 134,000 for the trip.

★

According to the Norwegian State mining corporation Norsk Bergverk A/S, nearly all the current year's niobium production from the corporation's Sove mines has been sold in advance. The output of niobium concentrate of high grade and containing under 1.0 pro mille phosphorous has been increased by 15 per cent by Norsk Bergverk to 450 annual tonnes.

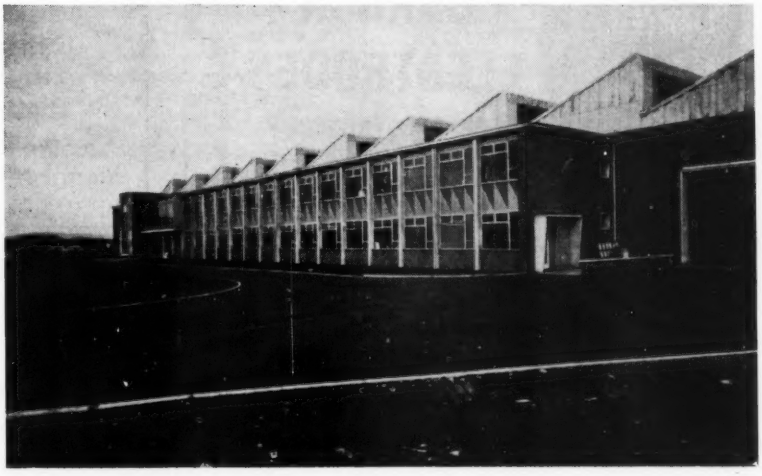
★

The Broken Hill Proprietary Co. has let a contract for the supply and erection of plant to treat the extensive deposit of scree on the western flank of Iron Monarch, South Australia. Ore available in the deposit is estimated at 20,000,000 tons. It is expected to treat 1,200,000 tons of scree per year for an annual production of 800,000 tons of concentrates averaging about 60 per cent iron. Cost of the plant will be £A1,100,000 and completion is expected by May, 1962.

Mining Equipment Factory at Llanelly

The new factory of Crawley Industrial Products Ltd. at Llanelly, South Wales, was opened on Wednesday last week by Niall Macpherson M.P., Parliamentary Secretary to the Board of Trade. The need for the factory has arisen through Crawley's concentration upon the problems associated with thin seam coal mining and the resultant increase of business that made new factory space an urgent requirement. This mining equipment factory will aid in solving the unemployment difficulties of Llanelly.

The factory occupies nearly 100,000 sq. ft. on an 8 acre site. Crawley is looking ahead and the present layout must be related to the ultimate plant. The envisaged quantities of raw material to meet a total traffic of up to 2,000 tons per month have necessitated the provision of a railway spur into the stockyard and also a spur directly into the factory.



Metals and Minerals

Outlook for Aluminium

The key factor in the current phase of the aluminium industry may well be turnover. Aluminium Ltd., at any rate is now placing the emphasis on the volume of sales rather than on price to increase the return on its assets, so Mr. Nathaniel V. Davis, president of the company told shareholders at the annual meeting in Montreal last Thursday. He said the current price structure is partly responsible for the relatively low return being earned on assets but the volume of sales is also important. "Should the pressure on prices increase further in the present conditions of intense competition, we are in a better position than many of our competitors to withstand the impact on earnings", he stated. "The major economic force at work in the primary aluminium industry today is the imbalance between supply and demand. Developments in 1960 have not changed the prevailing relationship between these factors."

Judging by the plans of most producers, considerable additional capacity is scheduled to be installed during the next five years. No exact figure can be forecast but an increase in capacity of 1,000,000 tons over the present level represents a fair estimate. Taking into account the existing 1,000,000 tons of idle capacity, this will mean finding and developing markets for something like an additional 2,000,000 tons over the 1960 estimated consumption of primary aluminium of some 3,500,000 tons.

In the United Kingdom, while the major aluminium companies are intensifying their search for new markets and particularly to lessen their dependence on the motor industry which takes about one-fifth of the output, they may find demand from this quarter rising if motor companies switch in a big way over to aluminium engine blocks. However, in other fields the electrical industry is beginning to use more aluminium in its products besides cables, and the chemical industry is making more use of aluminium because of its anti-corrosion properties. In some markets, however, the price factor still operates to aluminium's disadvantage, notably in the canning industry, a particularly attractive field for aluminium producers as, indeed, is the building industry where important developments are expected this year.

The search for new outlets for aluminium has undoubtedly been stimulated by the entry of leading North American primary producers into the British market. Packaging of consumer products, hitherto disregarded as a worthwhile market, has been the subject of an intensive advertising campaign based on experience in the U.S. market.

British Aluminium, jointly owned by Reynolds Metals and Tube Investments, and Alcan Industries are believed to be producing about 100,000 tons of aluminium a year but still below their maximum capacities. Another large producer, James Booth Aluminium, jointly owned by Kaiser and Delta Metal is expecting to bring its new rolling mill into operation during 1961 and no doubt has plans to widen its range of products.

★

Aluminium - Industrie Aktiengesellschaft of Chippis has recently started the building of a new aluminium smelter at Steg, in the Valais. The new plant will commence operations in 1962 with an initial capacity of some 20,000 tons. In 1960 the company produced some 35,180 tons of crude aluminium at its Chippis works—15 per cent more than in 1959.

★

The reduction plant of the Anaconda Aluminum Co. at Columbia Falls, Montana, has resumed full operations with the reactivation of 30 idle reduction cells. The plant has been producing at approximately 87½ per cent capacity since July, 1959. The reactivation brings the plant up to its newly rated production capacity of 65,000 tons annually.

INDIAN MICA INDUSTRY IN DOLDRUMS

The Indian mica industry is now going through a critical period. The sudden and sharp fall in the demand for mica

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MAP OF THE GOLD MINES OF THE KINROSS AREA

Copies of this map, prepared by *The Technical Map Service* of Johannesburg, are now available in London. They show (as at November 1959):-

- the exact position of each mine on the field.
- where on each property boreholes have been sunk, and what has been the core recovery on reef intersection.
- what shafts are being sunk.

Accompanying this map is a small outline map, bringing the borehole results up-to-date as at October 1960.

★While a mine is at the development stage, it is of vital importance to have a visual picture of its position in relation to the field as a whole. Otherwise the quarterly results published by the companies lose much of their significance.

★Results reported from adjacent mines often have a direct bearing on the one in which you are interested, which, however, can only become apparent if you have clearly in mind the position of the properties in relation to one another.

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The Mining Journal
Price 25s. (plus 1s. postage)

from foreign countries since the beginning of this year has led to the closure of many small factories. About 75 per cent of the American buyers and 50 per cent of British buyers, have cancelled their orders with the mica dealers in Bihar. It is reported that these countries are showing a preference for Brizilian mica, which is considered to be the main reason for the slump in the Indian industry.

India's exports of mica in the first quarter of this year amounted to only 7,070 tonnes, a fall of about 1,900 tonnes compared with the exports in the corresponding period of last year. Exports have been running at a declining rate, the tonnage exported in March, 1961 being some 620 tonnes lower than February despatches.

Because of an empty export order book a big mica factory at Giridih has been completely shut down. About 6,000 workers have been laid off from both mines and factories in the area. It is also understood that more than 50 per cent of the unregistered small mica factories at Kodarma, Jhumri-Telaiya and Domchanch have remained closed during the last two months.

GREEK NEGOTIATIONS WITH INCO

Mr. Bodossakis-Athanassiades, the chairman of Greek Chemical Products who recently negotiated an agreement with International Nickel of Canada for the exploitation of the ferro-nickel mines in Larymna, Central Greece, will visit London this week.

An agreement in principle was reached in January this year between the Greek Chemical Products and Fertiliser Co. and International Nickel providing for an investment by the Canadian company of $20,000,000 in the new project.

Greek Chemical Products holds the concession for the exploitation of the Larymna mines. Mr. Bodossakis-Athanassiades will be accompanied by Professor L. Moussoulos, who is the inventor of a special process for the enrichment of nickel ore.

According to reliable sources, Mr. Bodossakis-Athanassiades will have further talks in London with representatives of International Nickel on the active exploitation of the Larymna mines and processing the output by Professor Moussoulos's method.

LOWER U.S. BERYLLIUM PRICE

Brush Beryllium Corporation of Cleveland has announced a 15 per cent price cut in blend grade beryllium powder. This has reduced the price of minimum base lots of 20,000 lb., pure beryllium powder blend to $54 per lb. from $64.

It appears that the price reduction reflects operating economies resulting from expanded production at Brush Beryllium's Elsmore Ohio facility.

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Copper · Tin · Lead · Zinc

(From Our London Metal Exchange Correspondent)

With the exception of tin, prices have shown very little movement during the period under review, although the optimistic forecasts from across the Atlantic continue to grow in volume. The tin market has entered into a period of consolidation after its recent rapid rise.

U.S. COPPER PRICE RISING

The general price structure in the copper market has moved upward during the week with rises in the Canadian, Belgian and U.S. producer and customs smelter prices. Most observers feel, however, that this is only a first step towards a still higher level. The London Metal Exchange quotation and those on Comex have already gone to a level which discounts a further rise, and it seems unlikely that prices will go very much higher. The Belgian price was raised on Tuesday from the equivalent of 28.80 c. per lb. to the equivalent of 30 c. per lb. Antwerp or New York. On the same day the U.S. customs smelters and then the main U.S. producers raised their price from 29 c. per lb. to 30 c. per lb. During the first half of the week, however, the customs smelters again raised their price for No. 2 scrap to 25¼ c. per lb., which seems to indicate that a further advance in the copper price cannot be long delayed.

Activity in Europe has been at a lower level than for some weeks, but this can probably be attributed to the May day holiday and the fact that European prices had already gone well ahead of the then existing U.S. quotations. From the U.S. reports are that consumption for April will be considerably better than in the previous months, and it seems that with the Japanese purchases of scrap and the price parity which has been against the shipment of metal to the U.S., the availability may be the lowest for some time. In fact, this trend was already apparent in February when the tonnage of domestic output plus imports were the lowest for almost a year. Dealings on the London market have been of a routine nature, the contango has been maintained and stocks rose by 115 tons to a total of 15,057 tons.

On the labour front, negotiations have commenced on a new contract at Kennecott's western mines, and the initial moves are now being made in respect of the Salvador mine in Chile where the present contract expires on July 31. In Rhodesia the possibility of trouble at Mufulira, referred to last week, did not develop. However, with the political developments in the Congo once more coming to the fore, the African situation still weighs on the bullish side of the scales.

PROFIT TAKING SUSTAINS MARKET'S TIN STOCKS

After the recent sustained rise in the price of tin, it is not surprising that a halt has now been called and more attention is being paid to the existence of an appreciable contango, as well as to the fact that stocks in the U.K. are still higher than at the beginning of the year. These facts appear to contradict the generally accepted opinion that the metal is in under-supply; this apparent contradiction, however, is probably explained by the fact that metal bought three months ago is now falling due and as it shows a good profit, is being sold, whereas there is now little incentive for new long positions to be built up. When this happens the metal must be financed, and with money scarce the establishment of the appreciable contango is easily understood.

Rumours continue to circulate that the U.S. government is taking some decision on the release of the 4,000 tons of tin, which can be disposed of fairly easily, but as late as Tuesday official spokesmen were still denying that any decision had been taken. It seems probable that should this tin become available to the market, it will be done in such a way as to strengthen the buffer stock manager's hand in keeping the price around its present level.

Stocks in the U.K. fell last week 190 tons to a total of 9,927 tons. On Thursday the Eastern price was equivalent to £861⅜ per ton c.i.f. Europe.

LEAD AND ZINC MARK TIME

The lead and zinc markets have been uninteresting, with lead stocks falling 15 tons to a total of 11,914 tons and zinc stocks rising 267 tons to a total of 5,112 tons. Reports from the U.S. indicate that consumption of lead remains satisfactory and that offtake to the galvanizing industry has increased. Yet there is still little sign of the diecasters re-entering the market and, until this happens, little movement can be expected in the market. There is still no news of the progress of the barter transaction with the U.S. government involving surplus supplies of lead now in producers' hands, but some news will have to be forthcoming before the middle of the month and until then it seems likely that the market will mark time.

OFFICIAL TURNOVERS

Official turnovers (in l.tons) for the week ending April 28, with the previous week's figures in parentheses, are:

Copper	16,575	(14,300)
Tin	1,610	(1,320)
Lead	8,675	(8,525)
Zinc	5,950	(6,225)

Closing prices are as follows:

	April 27		May 4	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£232½	£232¾	£238¼	£238½
Three months ..	£234	£234½	£239½	£240
Settlement ..	£232½		£238½	
LEAD				
Current ½ month	£67⅞	£68	£67½	£67⅝
Three months ..	£69	£69⅛	£68⅝	£68½
TIN				
Cash	£840	£842	£850½	£851
Three months ..	£848	£849	£854½	£855
Settlement ..	£842		£851	
ZINC				
Current ½ month	£83½	£84	£83½	£83½
Three months ..	£83½	£83⅞	£83½	£83½

LONDON METAL AND ORE PRICES, MAY 4, 1961

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £230 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 11s. 0d. lb.
Cerium (99%) net, £15 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 250s. 10½d.
Iridium, £20/£23 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Magnesium, 2s. 2½d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £600 per ton
Osmium, £18/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £28/£28½
Quicksilver, £67 ex-warehouse
Rhodium, £43/£45 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 46s. 6d. per lb.
Silver, 79½d. f. oz. spot and 80d. f'd.
Tellurium, 37s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	27s. 0d./32s. 0d. per unit c.i.f.
Beryl (min. 10 per cent BeO)	270s./275s. per l. ton unit BeO
Bismuth	65% 8s. 6d. lb. c.i.f. 18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable 48%) (Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
,, Hard Lumpy 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
,, Refractory 40%	£11 0s. 0d. per ton c.i.f.
,, Smalls 44% (Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1) Nb_2O_5 : Ta_2O_5	165s./170s. 0d. per l. ton unit c.i.f.
Fluorspar—	
Acid Grade, Flotated Material	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)	156s. 0d. ex. works
Lithium Ore—	
Petalite min. 3½% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O	75s./85s. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%-48%) basis 60s. 0d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)	nom.
Molybdenite (85%) basis	8s. 11d. per lb. (f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO_2 (prompt delivery)	£25/£25½ per ton c.i.f. Aust'n
Ilmenite 50/52% TiO_2	£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	119s. 0d./123s. 0d. per unit c.i.f.
Vanadium—	
Fused oxide 95% V_2O_5	7s. 6d./8s. per lb. V_2O_5 e.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	£16 ton c.i.f

Mining Finance

The Course of Copper Profits

As may be seen from the table below copper profits of the Rhodesian Selection Trust group suffered a further setback in the March quarter with the exception of that for Chibuluma. The three producing mines and the parent R.S.T. now look like earning around 30 per cent less in the year to June 30 so some cuts in dividend must be regarded as virtually certain. The Roan Antelope, Mufulira and R.S.T. interims will have been announced by the time this is in print. Chibuluma should finally clear off its loan from the U.S. government in the coming financial year, leaving the way clear for the start of dividends in 1962-1963. This will be an important event for R.S.T. (which at present derives practically all its profits from the income of its 65 per cent stake in Mufulira) because it holds a similar percentage of the Chibuluma capital.

A lower metal price was the chief factor in last quarter's reduced earnings. Roan obtained an average of £220.9 a ton for its sales of 19,805 tons of copper. The average for Mufulira's 24,619 tons was £220.3. There is, however, some reason to hope that the recession in profits that has now persisted for a whole year may have come to an end, as the copper market looks as though it is becoming responsive to better demand in the United States. This week there has been a general increase in price by both American customs smelters and producers from 29 c. to 30 c. a lb., equivalent to roughly £240 sterling a ton.

In London since the end of March the cash price has improved from £225 a ton to £235 a ton pointing the way to a possibly higher average return to the mines this quarter during which there is also no reason to believe that any reductions in sales will have to be made. There is no doubt that share prices in the Rhodesian copper section are amply discounting such lower distributions for 1960-61 as may occur. Intrinsically quotations are, indeed, almost undoubtedly too low and from the market angle an improvement in the Rhodesian political situation would actually be of more importance than a rise in the metal price.

PROFITS BEFORE TAX

	Dec. Qtr. £000's	Mar. Qtr. £000's	9 mnths. to Mar., 1960 £000's	9 mnths. to Mar., 1961 £000's
Chibuluma	230	234	1,298	809
Mufulira	1,477	1,245	6,550	4,966
Roan Antelope	1,071	863	4,671	3,441
Rhod. Selection	1,083	936	4,952	3,655

London Market Highlights

South African gold share prices continued to drift lower in quiet and generally thin trading conditions this week. Spasmodic support from Johannesburg kept the market on a fairly even keel for a while. There was also occasional local buying for some time of the finance house shares, among which Gold Fields held firm at around 52s. 9d.

But on Wednesday reports from Johannesburg of police security movements in the African townships imparted a duller tone to the market. Admittedly price losses were usually limited to a few pence or so, but the market seemed very friendless indeed. Free State Geduld suffered more than most, falling 1s. 10½d. to 88s. 9d. Western Holdings which had previously been sustained by news of the over £1,000,000 April profit (only the second gold mine in the world to achieve this target, the first being West Driefontein) eased back 1s. 3d. to 112s. 6d.

In the finance group, Anglo American (121s. 3d.) and Union Corporation (43s. 6d.) both fell 1s. 3d. Among diamond issues, De Beers shaded to 123s. 9d. However, Consolidated African Selection held an earlier rise at 15s. which had been inspired by Press comment on the high yield offered and the anticipation that all would run smoothly under the newly independent status of Sierra Leone.

Depressing though the market movements seemed, it is worth while pointing out that at no time was there any pressure to sell. In fact there was always a potential buyer waiting on the sidelines. Whether South African shares are now in process of passing through the worst of their troubles it is not possible to say. Yet the feeling remains that given only the least encouragement, this market would stage a very strong recovery indeed.

Another depressed section which may be nearer to a recovery is the copper group, although the Rhodesians may have to face a few more squalls yet. The copper outlook showed signs of a distinct turn for the better this last week, even though this was not mirrored by the rather indecisive course of share prices. Still, Roan (5s. 9d.) and R.S.T. (10s. 6d.) were quite firm despite the further setback in March quarter's profits. The Rhoanglo group tended to improve a few pence and even Tanks rose 9d. to 24s. 6d. on Brussels buying regardless of the latest trouble in the Congo.

After lying almost dormant for several weeks the Australian lead-zinc section came to life following the excellent results and increased dividend for 1960 announced by New Broken Hill. The shares spurted 4s. to 50s. and there was a rise of 3s. 9d. to 81s. 3d. in Consolidated Zinc inspired by the hope that the parent would also have some unexpectedly good news to tell in its 1960 results. Unfortunately, the hopes were dashed when a day later Consolidated Zinc announced that its profits were lower and that the dividend was unchanged. So the shares dropped back smartly to an uneasy 77s.

As ever, the tin section continued on its steady upward course, this week being helped by an improvement in the Laos situation. Two stocks were outstanding: Tronoh with an advance of 5s. 6d. to 57s. 3d. and Tongkah Harbour, an Eastern favourite, which climbed 5s. to 80s.

CHARTERED'S ROYALTIES UP

While on this subject it is worth noting that the British South Africa Co., or Chartered as it is usually called, actually netted more from its Northern Rhodesian mineral royalties, rents and fees in the March quarter, the figure of £2,677,000, arrived at after providing for the Northern Rhodesian government's 20 per cent stake therein, comparing with £2,410,000 in the December quarter. This still leaves the total for the first half of the financial year to next September lower than that for the same period of 1959-60, the respective figures being £5,087,000 and £5,832,000.

Chartered's royalties are based on a sliding scale varying with the metal price, so in relation to the R.S.T. results for the past quarter, it is not immediately apparent why Chartered should have done better in that period. The copper price was lower and the group's production at an aggregate of 48,778 tons was only slightly more than the 48,393 tons in the December quarter. A rise in output by the Rhodesian Anglo American group mines, Rhokana, Nchanga and Bancroft, could, of course, provide part of the answer but could scarcely account for the whole of the difference. These mines do not issue quarterly reports, but it is at least known that, at the close of last year, Bancroft's production was running at a record rate, the figures for the month of December being a peak 5,200 tons.

It will be recalled that different methods are being adopted by the R.S.T. and Rhoanglo groups in implementing the 10 per cent cutbacks instituted in accordance with the policy of the world's major producers last October. Rhoanglo is cutting sales, but not necessarily production. Mr. Harry Oppenheimer has publicly stated that this method enables producers to establish reasonable stocks from which they can supply the market in times of shortage and so help to prevent the price from running away. The Rhoanglo group could thus be still pressing ahead quite strongly on the output side.

Chartered 15s. units naturally also remain under the shadow of Rhodesian politics because, despite the company's big diversification and investment programme, the mineral royalties from there still constitute the major factor in the earnings outlook. At 64s. 6d. Chartered offer 11.6 per cent on the 7s. 6d. paid for 1959-60, an extraordinarily high return for such a strong company even allowing for the possibility of some reduction in the distribution this year. But fears of possible trouble before the Northern Rhodesian situation is ironed out are likely to keep Chartered on a high yield basis for the time being.

RIO TINTO'S DIVIDEND OUTLOOK

Rhodesian copper also looms quite importantly in the life of another big company that comes up for discussion this week, namely Rio Tinto, which currently relies largely on the income from its Copperbelt investments for its distributable profits. Tinto's earnings for 1960 were commented on here at

length on April 21. This year the full report includes the chairman's statement as well as an analysis of the company's position by the managing director and chief architect of the group's world-wide diversification programme, Mr. Val Duncan. (See page 520).

The first thing that strikes the eye is the comment by the chairman, Mr. Gerald Coke, on the dividend outlook. He says that any mining enterprise is subject to the risks and fluctuations inherent in a hazardous business engaged in the production of raw materials. It would therefore be tempting providence for the Board to look too far into the dividend future. It is, however, hoped that the increased payment of 2s. 9d. for 1960 "which is 1.6 times covered can be maintained at least in respect of the current year". This is encouraging enough because, as indicated earlier in these notes, there will probably be some decline in the Rhodesian copper income in 1961.

The cover for the dividend does not include the Rio Tinto of Canada set-up, the earnings of which are again not consolidated and the surpluses from which are being used to write down the Canadian uranium investments. In the current year there will be the first impact on the parent company's accounts of the deal whereby most of the Kern Oil assets were sold to British Petroleum for 3,000,000 shares in that company. In fact, the recent B.P. final dividend will not come into Tinto's 1961 profit and loss account because it is being regarded as part of the actual capital deal. Even so, the B.P. interim due later on this year will rank as earnings for Tinto and it looks, in view of it no longer being necessary to amortize Kern's oil reserves, as though even this will mean some relative augmentation of Tinto's income for 1961.

The longer-term dividend prospects could be quite appreciably affected by the new double tax relief legislation being proposed in the coming U.K. Finance Bill because, on the face of it, it looks as though this legislation could lessen quite significantly the tax disadvantages at present weighing on the repatriation to London by Tinto of tax free earnings abroad. On this subject the chairman merely said cautiously that, until the text of the Bill is available, it is too early to assess the precise effect on the company or its stockholders.

As regards Canadian uranium, Mr. Duncan points out that with virtually all the loan money repaid substantial income will accrue from these operations during the remaining periods of the existing government contracts up to the end of 1966. Also there is, of course, a hope that the recently revealed extra contract between Canada and the U.K. for the supply of uranium may benefit the Tinto group ultimately in whatever revised and re-negotiated form it comes into force. The Tinto group's integrated producing company, Rio Algom, could conceivably rank for something like half the 12,000 s.tons of concentrates involved in this contract, but at what price is, of course, anybody's guess.

Finally, Mr. Duncan sums up the management policy of the group. Diversification has been both geographical and functional. Interests now cover a wide range of minerals including copper, emeralds, gold, oil, pyrites, thorium, uranium, vermiculite, blue metal and other building materials and these interests range over four continents. Tinto does not solely confine itself to mining. Its policy, Mr. Duncan says, is to enter into industrial activities and investments where they are logical developments of the mining operations or where the group's expertise can be profitably employed.

Rio Tinto 10s. units are 43s. 9d. ex dividend to yield 6.3 per cent. They look to have long-term growth possibilities, but may be held back in the medium-term by investment nervousness about Africa which can in particular strike Continental investors. A substantial part (possibly over 50 per cent) of the Tinto equity is still held in France and elsewhere on the other side of the Channel.

GOOD PROGRESS AT ZANDPAN

Two points of note emerge from Mr. Bernstein's generally encouraging statement to shareholders, circulated with the report and accounts of Zandpan Gold Mining Co. (See page 523).

In the first place he confirms that available funds will be sufficient to finance the completion and commissioning of No. 1 Shaft (scheduled for the early part of next year) and also for development during the ensuing year, the rate of which will be built up as rapidly as possible. It will be recalled that all the boreholes on this property giving more that 200 in.-dwts are within 7,000 ft of the No. 1 Shaft.

Further finance will, of course, be required to sink the No. 2 Shaft, erect a mill and bring the mine to production.

Mr. Bernstein also revealed that the shaft is now to be sunk to its original planned depth of 7,500 ft. immediately, instead of suspending shaft sinking at 6,800 ft. in order to carry out initial development with shaft sinking equipment. This is because exploratory drilling has disclosed a downward displacement of about 500 ft. in the reef in the area of the shaft.

INTRIGUING WEST WIT BOREHOLE

Further evidence has come from West Witwatersrand Areas that the Ventersdorp Contact Reef appears to extend economically at depth on the eastern side of the Libanon mine in the Far Western Rand. Borehole No. 21 on the farm Rietfontein 349 has cut this reef again in a second deflection with the high value of 3,101 inch-dwts, a complete core recovery assaying 95.4 dwts. gold per ton over a corrected width of 32.5 in. This compares with 1,318 inch-dwts, or 41.2 dwts over 32 in., in the original hole. In the first deflection the reef appears to have been ousted by an instrusive. The depth of both reef intersections is 8,490 ft.

The results from the further drilling that will no doubt take place in this region will have to be awaited before jumping to conclusions but, in conjunction with the fact that the V.C.R. has been opening up well from development in the adjacent southern part of Libanon, it certainly seems as though there may be eventual scope here for either a separate mine altogether or more likely for an extension of the Libanon mine itself in a south-easterly direction. A mutually satisfactory arrangement could no doubt be come to between West Wits and Libanon, the former having floated the latter, and both concerns being in the Consolidated Gold Fields group.

Borehole 21 is about a mile from the Libanon boundary and just on two miles from that company's new Harvie-Watt shaft.

CONS. ZINC & NEW BROKEN HILL

The rise in New Broken Hill's net profit for 1960 from £796,238 to £1,137,385 and the stepping up of the dividend on the 5s. shares by 9d. to 3s. tax free with a final of 2s. raised market hopes early in the week that Consolidated Zinc, which is the parent house of this group and which holds a 32 per cent stake in N.B.H., might show equally impressive results. There was a sharp disappointment on Wednesday when Consolidated Zinc announced a maintained distribution of 4s. per £1 share and a drop in net profit of £367,607 to £2,295,660.

It is fair to assume that Zinc Corporation, Consolidated Zinc's Australian lead-zinc producer which operates next door to N.B.H., will have done better last year for the same reasons as N.B.H., namely rather higher metal prices and increased zinc production, only partly offset by a reduction in lead output in conformity with world mining policy. So, Consolidated Zinc's setback must presumably have come from some other facet of its world-wide activities which include the Imperial Smelting company in the U.K. In the circumstances it is probably a measure of confidence that the dividend has been maintained, especially in view of the large sums of money that the company will require for the big Australasian bauxite venture in which it is being partnered by Kaiser Aluminum and in which the British South Africa company is taking a sizable financial stake.

Consolidated Zinc fell 4s. 6d. to 77s. following the results. At this price the yield after allowing for the final dividend of 2s. 9d. included in the price is 5.3 per cent. New Broken Hill, on the other hand, improved to 50s. cum 2s. tax free dividend to yield 10.2 per cent. The yield discrepancy arises from the fact that N.B.H. is solely dependent on its lead-zinc mining operations, and the metal prices are now below last year's averages, whereas Consolidated Zinc's interests cover a large industrial segment in Australia and the U.K. as well. The chairman of both is Mr. L. B. Robinson.

PENGKALEN'S REVENUE SUBSTANTIALLY INCREASED

With a considerably increased revenue from the sale of tin ore during the year to September 30, 1960, Pengkalen have taken the opportunity of charging £90,233, incurred on major dredge repairs, to the profit and loss account. The effect of this charge has been to show a loss on the profit and loss account of £25,727, though the actual mining profit was £73,578. It is estimated that the life of the mine is about 12 years.

A final dividend of 4½d. has been declared bringing the total for the year to 1s. The cost of this 1s. dividend is £49,000 and, after transferring £52,708 from reserves to the appropriation account, the balance carried forward stood at £36,683 as compared with £62,035 the previous year.

The directors have also announced the second interim dividend for the current year at 4½d. bringing the total to date to 9d. as compared with 4½d. for the first two interim dividends of the previous year.

RIO TINTO

INVESTMENTS IN FOUR CONTINENTS

The 88th Annual General Meeting of The Rio Tinto Company, Limited will be held on June 1 at Barrington House, 59 Gresham Street, London, E.C.2. The Statement by the Chairman, Mr. GERALD COKE is supported by a Review of Operations by the Managing Director, Mr. VAL DUNCAN. Both are given here in an abridged form.

THE CHAIRMAN'S STATEMENT

Accounts

The Chairman's Statement is prefaced by a reference to the Review of Operations by the Managing Director, which includes comment on some matters which would previously have been included in this Statement.

In the Consolidated Statement of Profit and Loss the increase of approximately £700,000 in the profit before taxation is due mainly to an increase in Investment Income. There was a substantial decrease in the income derived from the Kern subsidiaries. The figure of £375,000 against £250,000 in the previous year for amortization of oil and ore reserves includes a sum for writing down the premium paid for the purchase of the shares in the Cam & Motor Mine to which reference was made in the Chairman's Statement last year.

It will be seen in the Consolidated Balance Sheet that the net figure at which Exploration and Development Expenditure has been capitalized (after deduction of the Exploration and Development Reserve of £2,460,000) is £1,017,000 as compared with £888,000 in the previous year. The difference represents expenditure on development projects, principally Palabora.

The advance payment of £1,016,000 (Can. $2,840,000) is the amount paid by a wholly owned Canadian subsidiary, Tinto Holdings Limited, to Mr. J. H. Hirshhorn in November 1960 on account of the purchase of his shares in The Rio Tinto Mining Company of Canada Limited. The shares did not actually pass into Tinto Holdings' possession until after the end of the year upon payment of the second instalment of Can.$5,000,000. The balance of the purchase price, Can.$4,750,000, is due for payment not later than January 1962.

The change in the value of investments in associated companies in Canada is due to the sale of the Northspan 5¾ per cent Bonds to The Rio Tinto Mining Company of Canada Limited prior to repayment on January 1, 1961, and to the fact that the shares in Northspan, Pronto and Milliken Lake have been exchanged for Rio Algom shares and are, therefore, included in the total of investments in The Rio Tinto Mining Company of Canada and its subsidiaries.

Taxation

Your Board welcome the announcement by the Chancellor of the Exchequer in his Budget Speech of the treatment to be given to British companies engaged in overseas development operations where tax concessions are granted by the government of the country concerned. Until, however, the text of the Finance Bill is available it is too early to assess the precise effect on your Company or its stockholders.

Any mining enterprise is subject to the risks and fluctuations inherent in a hazardous business engaged in the production of raw materials. It would, therefore, be tempting Providence if your Board were to look too far into the future in forecasting their dividend policy. They have reason to hope, however, that the increased dividend of 2s. 9d. which they recommend and which is 1.6 times covered, can be maintained at least in respect of the current year.

Oil and Gas

As has already been announced your Company has agreed to dispose of the bulk of its interests in oil and gas to The British Petroleum Company Limited for a consideration of three million British Petroleum shares and a continuing interest in certain exploration prospects, together with a further amount to be determined in respect of certain properties. Your Board have felt that an interest in oil is important in a company which is concerned with the mining of natural products and is perhaps the more important because oil, as a source of power, is complementary to your Company's interest in the development of uranium. The holding of British Petroleum shares, which it is our intention to retain in our portfolio of investments, will provide for stockholders a much more diverse and stable interest in the oil industry than would be the case were we operating through our own subsidiary, limited as it was to the production of crude oil.

The Board would like to take this opportunity of thanking Mr. Ivey and his staffs in London, Trinidad and the United States of America for their loyal support during their four years' association with us.

Canada

In the Chairman's Statement last year the future of uranium was again fully examined, in the light of the facts and forecasts then available to us, as to the world's requirements for atomic power both for defence and for peaceful purposes. It would be possible, but not very profitable, to review this situation again each year, taking into account any fresh information or prophecies which would have been made in the interim period. It is not proposed to revert to the

	1960 £	1959 £
Net profit after deducting minority interests and providing for amortization of oil and ore reserves:		
Group (excluding Rio Tinto Canada and subsidiaries)	2,042,000	1,847,000
Appropriations:		
Capital Reserve	2,000	247,000
Reserve against Exploration and Development	185,000	401,000
(1959 included appropriation of £226,000 by a wholly owned subsidiary)		
Net Profit Parent Company	1,096,000	886,000
Reserve against Exploration and Development	185,000	175,000
Ordinary Dividend	1,229,000	894,000
At the rate of	27½% less tax at 7/9d.	20% less tax at 7/9d.
Proportion of profits of Rio Tinto Canada and subsidiaries attributable to Parent Company not included in Group profit and not yet available for distribution as dividends	1,236,000	1,068,000
Less: Proportion attributable to Parent Company of depletion of investments. (1959 included proportion of intangible assets)	*93,000	670,000
	1,143,000	398,000
Balance brought forward from previous year	1,451,000	1,053,000
Balance carried forward	£2,594,000	£1,451,000

*** The consolidated profits of Rio Tinto Canada have been utilised for the depletion of investments. Rio Algom, a non-consolidated subsidiary, by reason of restrictions attached to bonds (now redeemed) taken over from a predecessor company, was unable to pay a dividend in 1960. In 1959 dividends were received from certain non-consolidated subsidiaries making a larger amount available for depletion of investments.**

uranium situation in the annual Chairman's Statement unless there has been some substantial change, and at present there would seem to be no reason to modify in any important particular the general view of the future prospects for uranium set out in last year's Statement.

The events of the past year in Canada have been set out in detail in the Reports of The Rio Tinto Mining Company of Canada and of Rio Algom Mines and commented upon by the Hon. Robert Winters, the President of these two companies, and it is not, therefore, necessary to refer to them again here.

Africa

The future of the Central African Federation is, at this moment, clouded by political uncertainty and this is bound to affect not only the operations of the Rio Tinto Rhodesian companies but also the future of your Company's large investment in the Northern Rhodesian Copperbelt.

The dividends from these investments were for many years almost the sole source of income to your Company and of dividends to its stockholders, but over recent years income from other parts of the world has begun to accrue and this is now starting to reflect the diversification policy to which reference is made at greater length in the Managing Director's Review of Operations. Because of this your Board propose to continue the policy of paying out to stockholders a high proportion of the dividends received from Rhodesia.

Australia

Early in 1961 The Rio Tinto Mining Company of Australia Limited made a public issue of one million 5s. shares issued at 7s. This one million shares represents approximately 7 per cent of the issued share capital of Rio Tinto Australia and thus your Company is now a 93 per cent shareholder. This public issue was in line with the policy of giving facilities to local investors to participate in Rio Tinto enterprises once they have become established. The issue was heavily oversubscribed.

A proportion of the tax free profits from Mary Kathleen Uranium is being employed by our Australian associates to widen somewhat the basis of their activities and to carry the policy of expansion and diversification a stage further.

Your Board still feel, as was stated last year, that Australia presents exceptional opportunities for expansion, in the atmosphere of encouragement for business enterprise—and in particular for business enterprise based on Great Britain — in the wealth of raw materials which have only been partially explored and in the expanding market which the country presents at home and to which it has access in the developing countries of the Far East.

Moreover, there exists in Australia, as in Canada, the need to replace with some more permanent source of income the uranium interest at present represented by our holding in Mary Kathleen, by the time the present contracts run out.

Spain

The Directors record their pleasure at the satisfactory conclusion of the sale of two-thirds of your Company's Spanish assets. The final instalment in payment of this acquisition was received during the year and your Directors would like to take this opportunity of acknowledging once again their satisfaction at the happy relations which exist between them and Compañia Española de Minas de Rio Tinto, S.A.

Staff

Once again it is a pleasure to pay tribute to the work of our full-time colleagues in London and to the staff which works under them. Our happy relationship with our associates throughout the world is at once a testimony to the harmonious co-operation which London has maintained and a tribute to the loyalty and hard work of those who are responsible for our many activities in four continents.

PRINCIPAL OPERATING RESULTS

URANIUM

CANADA

Rio Algom Mines Limited

		1960	1959
Tonnage of Ore Treated	Short tons	5,050,000	6,134,000
Grade of Ore at Mill Head	Lbs. U_3O_8 per ton	2.39	2.30
Production	Lbs. U_3O_8	11,360,000	13,042,000
Gross Revenue	Can. $	129,619,000	141,934,000
Net Profit: (after deducting Can. $5,981,024 deferred revenue in 1960)			
Before Amortization and Pre-production Write-offs	Can.$	63,668,000	62,945,000
After Amortization and Pre-production Write-offs	Can.$	21,430,000	14,986,000
Outstanding Debt at Year End (Less funds on deposit with Trustee)	Can.$	32,844,000	99,019,000

AUSTRALIA

Mary Kathleen Uranium Ltd.

Tonnage of Ore Treated	Short tons	430,000	480,000
Tonnage of Waste discarded by Electronic Sorter	Short tons	48,213	—
Grade of Ore to Crushing Plant	Lbs. U_3O_8 per ton	3.42	3.36
Grade of Ore at Mill Head	Lbs. U_3O_8 per ton	3.75	3.36
Production	Lbs. U_3O_8	1,476,000	1,452,000
Gross Revenue	£A	6,499,000	6,475,000
Profit—After Special Reserve	£A.	1,850,000	1,968,000
Outstanding Debt at Year End, including Redeemable Cum. Pref. Shares	£A.	5,867,000	7,430,000

GOLD

AFRICA (SOUTHERN RHODESIA)

Rio Tinto Rhodesian Mining Limited (*Cam and Pickstone Mines*)

		1960	12 months ended 30 June, 1959
Tonnage of Ore Treated (ex Mines)	Short tons	393,000	379,000
Tonnage of Dump Material Treated	Short tons	758,000	726,000
Grade of Ore at Mill Head	Dwts/Ton	6.41	6.48
Grade of Dump Material at Mill Head	Dwts/Ton	1.29	1.33
Production	Ozs. gold	124,000	124,000
Gross Revenue	£ Stg.	1,555,000	1,542,000
Operating Profit	£ Stg.	502,000	492,000
Profit — After Amortization and Depreciation, before Tax	£ Stg.	128,000	257,000

CANADA

Preston Mines Limited (*Gold Operation only*)

		1960	1959
Tonnage of Ore Treated	Short tons	227,000	223,000
Grade of Ore at Mill Head	Dwts/Ton	4.86	5.30
Grade of Ore Recovered	Dwts/Ton	4.74	5.18
Production	Ozs. gold	54,000	58,000
Operating Revenue	Can. $	2,192,000	2,219,000
Operating Profit	Can. $	237,000	280,000

PYRITES AND ALLIED PRODUCTS

SPAIN

Compañia Española de Minas de Rio Tinto S.A.

		1960	1959
Deliveries: (i) Pyrites	Metric tons	839,000	707,000
(ii) Pyrites Cinders	Metric tons	169,000	36,000
(iii) Sulphur	Metric tons	32,000	33,000
(iv) Copper (Blister and Cathodes from all sources)	Metric tons	12,500	5,400
Production: Sulphuric Acid (August/December, 1960)	Metric tons	15,000	Nil

MANAGING DIRECTOR'S REVIEW OF OPERATIONS

The Managing Director begins his review with a résumé of the progress which has been made in recent years towards diversification of the Company's interests. He describes how this has taken place, not only by mining developments outside Spain, in Canada, Australia and Africa but also through associations with European and North American industrial concerns. Before dealing with the events of 1960, Mr. Duncan describes the Company's policy of management, investment and finance.

Management Policy

The diversification has been both geographical and functional. We now have interests in a wide range of minerals, including copper, emeralds, gold, oil, pyrites, thorium, uranium, vermiculite, blue metal and other building materials and these interests range over four continents.

Our interests are not solely confined to mining and our policy is to enter into industrial activities and investments where they are logical developments of our mining operations or where our expertise can be profitably employed.

Rio Tinto's expansion has taken place in the post-war era and in a changed world. We believe that a high degree of autonomy should be developed by our overseas enterprises and that this policy is essential in building up high calibre management. Moreover, we seek local shareholders in countries where this is possible and we like to regard the overseas countries as partners in our operations. When an overseas parent company has achieved autonomy there are broadly speaking only two major subjects on which it is essential to have concurrence between that company and London. These are top appointments and finance. This does not mean, of course, that we in London do not make any other contributions and we continue to provide technical, commercial, and financial services.

Travel is essential in such a group of companies and is constant in both directions from the centre to the perimeter and *vice versa*, for only by personal contact and discussion is it possible to get the best results.

The pace of expansion is limited by what any one organization can do at any one time in the development of natural resources in the world and these limitations are human as well as financial. On the human side we have to be careful not to overstrain our technical and commercial resources.

The financing of major developments of natural resources in the world has undergone a considerable change since the war. Projects have tended to become very much larger and, because of this, the time lag between arranging for the finance and the profit earning stage has tended to grow. Consequently, equity financing of these development projects only becomes attractive where substantial sums of money can be borrowed and interest on this debt treated as part of the cost of construction. The amounts involved are often beyond the scope of the private sector and recourse must be had to international bodies. The disability which United Kingdom companies engaged in the development of raw material resources overseas have been suffering, in regard to tax concessions granted by foreign governments which are not available for double taxation relief, has been recognized by the recent Budget. It is to be hoped that this will enable this country to take her rightful place in the development of the natural resources of the world in general and the Commonwealth in particular.

Against this general background I will now review the developments of Rio Tinto in 1960.

Africa

In December 1959, Rio Tinto acquired the Cam and Motor Gold Mining Company (1919) Limited in Southern Rhodesia which has been operating for over forty years. We believe that the profitability of Cam and its associated mine Pickstone can be improved and detailed studies to this end are in progress. It will be some time before the extent of this improvement can be assessed. Patchway, a small mine near Gatooma on which eighteen months' development work has been carried out, should now be capable of increased production.

The Sandawana emerald deposits in Southern Rhodesia are producing high quality emeralds on a profitable basis and we have already recovered our capital outlay. The life of this deposit is difficult to forecast since at present the deposit does not lend itself to the orthodox methods of estimating reserves; but we are optimistic.

With reference to the Palabora deposit, which is a large low grade copper deposit in the North Eastern Transvaal, we have a controlling interest, and the other principal shareholder is the Newmont Mining Corporation of the United States. Palabora is managed by us and we have erected a 100 tons per day pilot plant which has now come into operation. This pilot plant programme is expected to be completed during 1962 when we shall know the final economic evalution. If, as is hoped, the deposit proves economic the ore will be extracted by open pit mining methods with an unusually low stripping ratio.

In July 1960 we purchased Emka Mining and Trading Company (Proprietary) Limited which owned a small high grade copper prospect at Onganya, near Windhoek, South West Africa. This operation is mainly at the prospecting stage, but small quantities of copper are being mined and disposed of. In October 1960 the Japanese firms of Nippon Mining Company Ltd. and C. Itoh & Company Ltd. purchased a 40 per cent interest in Emka and joined us in the exploration and development of this prospect. The Japanese companies have also signed a contract for the purchase of the entire output.

Canada

As has already been reported your Company recently acquired through Tinto Holdings Limited, its wholly-owned Canadian subsidiary, Mr. Hirshhorn's interest in The Rio Tinto Mining Company of Canada Limited, thus giving your Company an 84 per cent interest in Rio Tinto Canada. This has substantially increased the beneficial interest in Rio Algom Mines Limited, the company formed in 1960 to merge into one company all the uranium companies in Canada under our management. The beneficial interest of your Company in Rio Algom is about 37 per cent.

During 1960 Rio Algom made striking reductions of working costs and increases in efficiency. This has been reflected in further considerable reduction of the company's bonded indebtedness which should shortly be entirely eliminated. When one considers that the Canadian uranium companies under our management have been reducing bonded indebtedness over the last year or so at a rate of around one million dollars per week the scale of those activities will be appreciated.

Originally some of the uranium contracts in Canada were due to expire in March 1962 and others in March 1963. Though the United States was unwilling to purchase any more uranium, Eldorado has agreed that we can stretch out our existing contracts and Rio Algom will therefore be in operation on its present contracts until around the end of 1966 when only one of our Canadian mines is scheduled to be operating; the closure of the other mines will be carried out on a phased basis to concentrate the production in the most economic producer.

If and when Canada regains a broader share of the market, we can reopen mines and make reasonable profits. Meanwhile, allowing for the payment of reasonable dividends by Canadian uranium mines, there should be substantial sums of money available for diversification to improve the profitability of the companies of the group.

Mention should also be made of Rio Tinto Dow, a company owned jointly by Rio Tinto and Dow Chemical of Canada Limited which manufactures thorium oxide. This activity could become important because thorium is extracted in the Elliot Lake deposits as a by-product of uranium and its uses are increasing.

A considerable research in industrial and other non-nuclear uses of uranium is being carried out in Canada by the Government and by a Research Foundation of which Rio Tinto is the largest contributing member.

Rio Tinto Canada controls through Preston Mines Limited a small gold mine in the Porcupine area of Ontario.

Australia

Mary Kathleen Uranium Ltd. had another successful year and production of uranium oxide was well maintained. An electronic sorter was installed during 1960 and went into operation in May. It has been discarding between 20 per cent and 25 per cent of waste rock previously sent to the mill and has resulted in increased mill efficiency. The large overburden removal programme was 60 per cent complete by the end of the year and should be completed during 1961. Although material containing 1,637,000 pounds of uranium oxide was mined during the year, the reserves were reduced by only 167,000 pounds due to the discovery of additional ore.

As reported last year, it was decided to build a second dam for the storage of sufficient water to support operations. This dam was completed before the wet season and has already been filled. In the meantime the quantity of water stored in the original dam has already increased substantially and there is now no anxiety regarding water supply.

During the year Fitzpatrick Industries Pty. Limited was formed to acquire all

the issued shares of Ray Fitzpatrick Quarries Pty. Limited and Ray Fitzpatrick Contractors Pty. Limited. The operations of these companies include quarrying blue metal, sand winning, earth moving and plant hire in the Sydney area. Rio Tinto Australia holds a 75 per cent interest.

Large reserves of first grade blue metal have been established which will enable the proper development of the quarry to be planned as production increases. Production and sales from the quarry have steadily increased during the year, as did sales of sand. Reserves of gravel were also purchased in the vicinity of the Nepean River.

Since its formation Fitzpatrick has acquired a 51 per cent interest in Atlas Ready Mixed Concrete Pty. Limited. It is felt that there will be great demand for all materials for building and for road making in the rapidly expanding area of Sydney because of the increasing population.

Exploration continued in Tasmania in association with The Electrolytic Zinc Company of Australasia Ltd. In Queensland effort was directed particularly to copper projects north of Mt. Isa in association with Siamese Tin Syndicate Ltd. and Le Nickel S.A. Since the end of the year Tanganyika Holdings has joined in this latter programme.

United States of America

The Pyrites Company Inc., had quite a good year but the prospects for 1961 are poor because this market for iron sinter will cease once the present stocks of raw materials have been exhausted. Efforts are being made to increase the scale of the cobalt operations.

United Kingdom

Mandoval Limited, under our London management, increased the sales of vermiculite in 1960 by some 30 per cent as compared with 1959. In addition to the distribution of crude vermiculite, Mandoval, in association with various other organizations, is engaged in research to develop further uses for vermiculite in building and industry.

Thorium Limited, which was jointly acquired by us and Dow Chemie A.G. and is managed by us, processes crude thorium materials, including material from the Rio Tinto Dow thorium extraction plant in Canada. The company produces thorium products and other rare earth compounds for various industrial uses including optical glass polishing powders. Operations have been concentrated at Widnes where a new research laboratory was erected during 1960.

Spain

The gross profit of Compañia Española de Minas de Rio Tinto, S.A. for 1960 is expected to exceed the 1959 profit of Ptas. 110,645,000 (£660,000). This is due to increased exports of pyrites, to the higher sales of pyrites cinders and to the operation of a new Acid Plant. This plant recovers sulphur in the form of sulphuric acid from the smelter waste gases. Construction was completed in three years and the plant began operating in August. It is now producing acid at the scheduled rate of 65,000 tons per year.

A copy of the full Report and Accounts can be obtained on application to:

The Secretary,
The Rio Tinto Company, Limited,
Barrington House,
59 Gresham Street,
London, E.C.2.

Board Changes

The following have resigned from the board of Bremang Gold Dredging Co. Ltd.: Mr. C. J. Burns (chairman), Mr. C. H. Higgins, Mr. A. Hedley Williams. The following have been appointed to the board; Hon. E. Ayeh-Kumi (chairman) (Mr. A. E. T. Adjei, alternate to chairman), Sir C. W. Tachie-Menson, C.B.E., Mr. Mark Botsio, Mr. G. Munro (alternate—Mr. S. H. Robinson), Mr. H. Benyah.

The following have resigned from the board of Ariston Gold Mines (1929) Ltd.: Mr. C. J. Burns (chairman), Mr. C. S. Goddard, Sir C. W. Tachie-Menson, C.B.E., Mr. V. Whitehead, Mr. A. Hedley Williams. The following have been appointed to the board; Hon. E. Ayeh-Kumi (chairman) (Mr. A. E. T. Adjei, alternate to chairman), Mr. Mark Botsio, Mr. A. Adomako, Mr. S. H. Robinson (alternate—Mr. G. Munro), Mr. J. G. A. Renner.

The following have resigned from the board of Ghana Main Reef Ltd.: Mr. C. J. Burns (chairman), Mr. J. A. Griffiths, Mr. G. Houghton Brown, Sir C. W. Tachie-Menson, C.B.E. The following have been appointed to the board; Hon. E. Ayeh-Kumi (chairman), Mr. A. E. T. Adjei (alternate to chairman), Mr. Mark Botsio, Mr. H. A. Dodoo, Mr. S. H. Robinson (alternate—Mr. G. Munro), Mr. J. A. Danso.

The following have resigned from the board of Amalgamated Banket Areas Ltd.: Mr. C. J. Burns (chairman), Mr. J. A. Griffiths, Mr. G. Houghton Brown. The following have been appointed to the board; Hon. E. Ayeh-Kumi chairman (Mr. A. E. T. Adjei—alternate), Mr. T. E. Anin, Mr. H. A. Dodoo, Mr. G. Munro (Mr. S. H. Robinson—alternate) Mr. J. E. Cudjoe.

ZANDPAN GOLD MINING COMPANY LIMITED

(Incorporated in the Union of South Africa)

SATISFACTORY DEVELOPMENT PROGRESS

The 5th annual general meeting of Zandpan Gold Mining Company Limited will be held on May 30 in Johannesburg.

The following is the circulated review of the chairman, **Mr. B. L. Bernstein:**

Satisfactory progress continued to be made in the sinking of No. 1 shaft, which, on April 13, 1961, had reached a depth of 6,619 feet below the collar. The shaft remained in Ventersdorp lava to a depth of 5,686 feet before traversing the Ventersdorp Contact Reef and entering the Upper Witwatersrand Quartzites. The Ventersdorp Contact Reef in this area has proved to be of no economic interest.

In my review for the year ended December 31, 1958, I explained that in order to expedite exploratory development, No. 1 shaft would be sunk directly from surface to below the reef horizon instead of incurring the costly delay of stopping the surface shaft at the 5,000 feet level and then sinking a sub-vertical shaft to the full depth. While the overall advantage to be gained from this programme remains unaltered, it is now considered that when your mine reaches the production stage it will become necessary to provide winding capacity at No. 1 shaft in excess of that required for the development stage. This can be done, without losing the considerable benefits derived from using No. 1 shaft as a divided shaft for ventilation purposes, by installing a rock winder on the 5,000 feet transfer level. This underground winder will operate in the upcast section of the shaft and will deliver rock from the 7,400 feet elevation to a transfer loading box serving the surface winder, thus increasing the capacity of the surface winder from about 60,000 tons to 150,000 tons per month. To ensure that this arrangement can in due course be put into effect without curtailing production, the necessary excavations in the vicinity of the 5,000 feet level were made while sinking was in progress.

While excavating a main transfer level and pumping station on the 5,000 feet horizon, exploratory drilling was carried out. This drilling disclosed faulting, which has since been encountered in the shaft and which indicates that, although reef can now be expected at a depth of approximately 6,850 feet below the collar, there is a downward displacement of some 500 feet in close proximity to the shaft. Shareholders were advised in a single circular dated October 12, 1960, that it was planned to suspend shaft sinking operations about 100 feet below the reef horizon in order to carry out initial development, using shaft sinking equipment. In view of the faulting disclosed it has been decided to complete shaft sinking at a final depth of 7,500 feet and to equip the shaft before starting development. Shaft stations are being cut at vertical intervals of 150 feet between the elevations of 6,500 feet and 7,250 feet below the collar to provide adequate scope for advancing development simultaneously on several horizons. It is estimated that development work will be commenced during the first quarter of 1962.

It is estimated that funds received, together with those for which provision has been made, will be adequate to finance the completion and commissioning of No. 1 shaft and for development during the following year. During this period, the development rate will be built up as rapidly as possible. In order to enable the company to sink No. 2 shaft, to erect a reduction plant and bring the mine to initial production, it will be necessary in due course to raise further capital.

In the interest of economy, operations at the mine are still under the control of the manager of the Hartebeestfontein mine.

THE BRITISH PETROLEUM COMPANY

INCREASING DEMAND AND INCREASING COMPETITION

THE HON. M. R. BRIDGEMAN ON "50/50" AGREEMENTS

The 52nd Annual General Meeting of The British Petroleum Company Limited will be held on May 25 in London.

The following is an extract from the Statement by the Chairman, **The Hon. M. R. Bridgeman, C.B.E.,** which has been circulated to Stockholders :

The background against which the results should be viewed, is one of increasing demand coincident with increasing competition. Last year world demand for oil outside the Communist bloc rose by about 63 million tons or 7½%. In the U.S.A. demand rose by only 13 million tons or 3% whereas in Western Europe the increase was 29 million tons or 17%. This rising demand has, however, been accompanied by greatly increased competitive activity, due primarily to the "surplus" of oil to which reference is frequently made.

There is still a widespread belief that, in spite of the "50/50" agreements for sharing the profit arising from the production operation, the oil companies are depriving the producing countries of a fair share of the profits. I would like by reference to our results to place this suggestion in a more accurate perspective.

The main increase in world production in 1960 took place in the Middle East where the increase was over 33 million tons. Payments to the Middle Eastern countries under the "50/50" agreements are based on posted prices, and the total sum included in our 1960 accounts for such payments was £128,000,000.

Our own Group profits, which last year amounted to just over £62 million, are related to the price we realize for the oil when we sell it; and, to the extent that such sales are in the form of refined products, these profits represent the net result of all the operations involved, and not merely those related to production.

It is not possible for us to bring to the consumer the ever greater quantities of oil which are required unless we provide not only the production facilities in the producing areas, but also the tankers, pipelines, refineries, and marketing installations which are necessary. But although the increase in revenues of the producing countries depends on the availability of all these facilities on a steadily mounting scale, the Governments concerned are not obliged to spend on the provision of such facilities any of the money they receive from oil royalties and taxes.

The effect of the "50/50" agreements in 1960, so far as we are concerned, can be summarized as follows. The amount payable to the Middle Eastern Governments was five times the sum the stockholders will receive out of the 1960 profits if the amount now recommended for distribution is approved. To maintain the Group on a competitive basis, we had to incur capital expenditure of £112 million, and once more had recourse to outside borrowing. The oil industry's part of the "50/50" bargain thus involves not only the acceptance of the risks—which are very considerable — but also the responsibility for providing all the capital for the refining, transport and marketing, as well as for the actual production of the oil. I do not think this can reasonably be described as a bad bargain for the people of the producing countries.

Turning now to the year's results, BP Group sales of crude oil and products at 73 million tons were the highest in the Company's history, nearly 10 million tons or 15% above the corresponding figure for 1959; and as already stated, the Group's net income after taxation was just over £62 million compared with just over £63 million in 1959. The attention which we are giving to our costs has enabled us to show a welcome reduction per ton in our operating expenditures, but sales income continues to be adversely affected by the competitive nature of the markets. Nevertheless, the Group income before taxation shows an increase of over £13 million.

As to the transfer of £31 million to General Reserve, this will with the other transfers which have been made bring the total of the Company's capital and revenue reserves together with the Share Premium Account to £263 million. The Directors recognize that with the 1960 additions the reserves have reached a high level and they contemplate reviewing later in the year the advisability of measures for the capitalization of reserves in part, if this then appears warranted.

As to the future, I hesitate to make any positive prediction, optimistic or otherwise. At the same time, I think I am safe in saying that BP is well equipped to play its part in meeting the demand for oil, which can be expected to continue increasing throughout the free world. But it does not follow that our profits after tax will increase in proportion to any increase in the tonnage of our sales.

AN EXPERIENCED

GEOLOGIST/EXPLORATION ENGINEER

is required immediately by a well-known British mining company to take charge of a Reconnaissance Prospecting investigation in East Africa and elsewhere.

Applicants must be over 25 years of age and preferably under 40, and be in possession of an honours degree in Geology or Mining Geology. The principal requirement is a practical and imaginative approach to a variety of geological problems. As the successful candidate will be responsible for the organization and direction of all aspects of an investigation, only men of high all-round ability need apply.

Salary depending on experience, about £2,400 p.a. plus allowances.

Please send particulars of age, qualifications and experience in confidence to Box 980, c/o Walter Skinner, Ltd., 20, Copthall Avenue, London, E.C.2.

As from April 10, 1961, Hickson's Timber Impregnation Co. (G.B.) Ltd.'s head office telephone number will be : Castleford 3841; Home sales extension no. 332; Export sales extension No. 334.

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The Telephone number of the National Coal Board is now Belgravia 2020.

One B.B.S.2 Boyles Drilling Rig complete with Gardner-Denver Pump, Mast and two B.B. engines all mounted on four wheel independent jacking trailer together with all ancillary equipment, extremely reasonable.
Ring Uxbridge 34604 for appointment to view.

SENIOR GEOPHYSICIST

Required to set up and supervise a geophysical section for both aerial and ground work in mineral exploration. Applicants should be experienced in all phases of modern geophysical techniques and have a minimum of a Master of Science in geophysics.

Eighteen months' contract including two months of vacation with pay. Liberal housing allowance and extra allowance for field work. Transportation expenses paid. Further particulars upon application.

Apply giving full details of qualifications and experience to :

The Director of Mineral Resources,
P.O. Box 345,
Jeddah, Saudi Arabia.

UNIVERSITY OF DURHAM
KING'S COLLEGE
NEWCASTLE UPON TYNE, 1

The Council of King's College invite applications for a Lectureship in Metalliferous Mining, tenable in the Department of Mining Engineering.

Candidates should possess an Honours degree in Mining Engineering or the equivalent, and should have had considerable experience in Metalliferous mining.

The commencing salary will be at an appropriate point on the Lecturers' scale £1,050 - £1,850 per annum in accordance with age, qualifications and experience of the successful applicant, F.S.S.U. and Child Allowance. The department has considerable facilities for research in several fields.

Further particulars may be obtained from the Registrar and Secretary of King's College to whom applications, together with the names and addresses of three persons to whom reference may be made, should be addressed so as to reach him not later than May 31, 1961. Overseas candidates may in the first instance make application by cable.